

UTAH AND ITS MINERAL WEALTH

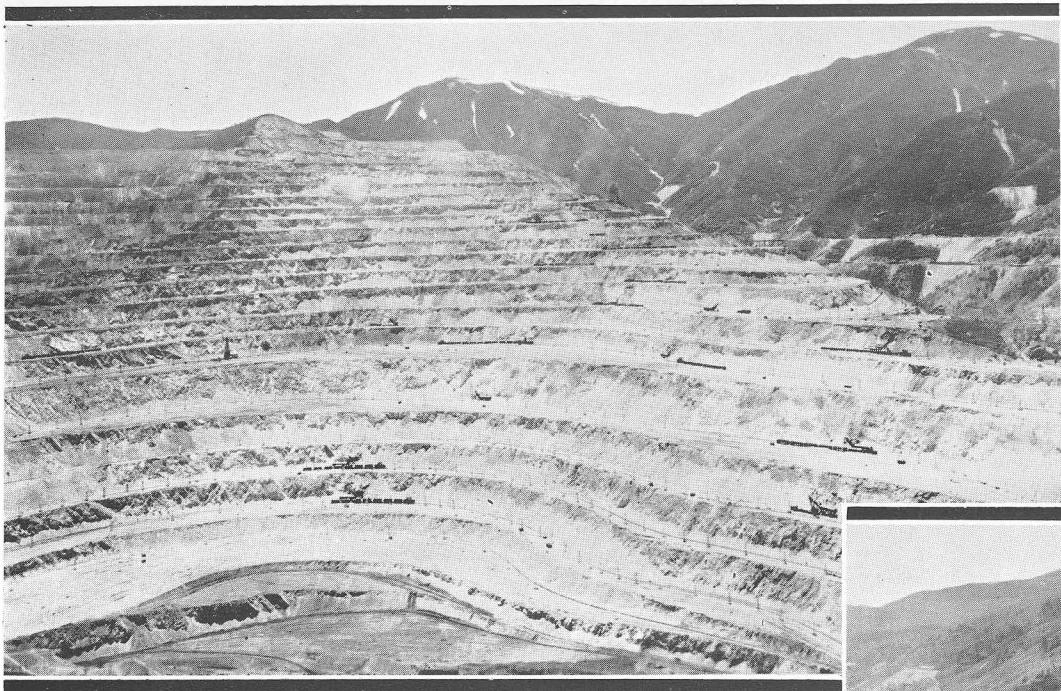


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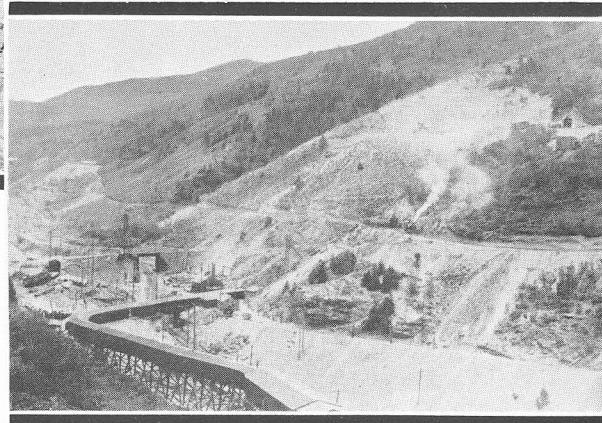


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Here are "past and present" views of a titanic mining operation—the Bingham workings of the Utah Copper Company, the largest surface copper mine in North America. Below is shown the mountain as it looked in 1903, when the first steam shovel began to tear away at the great pile of low-percentage copper ore. Ceaseless and increasing activity since that time has changed the scene to an extent that is almost unbelievable, yet it has scarcely scratched the surface of this huge ore-bearing mountain.



Today, on more than a score of terraces, giant electric shovels are scooping great bites out of this mountain of ore. The material is loaded into railroad cars and taken to the concentrating mills at Magna and Arthur, twenty miles away. An indication of the magnitude of these operations may be gained from the fact that every day more material is handled than was moved in any one day of the most intensive work during the digging of the Panama Canal. Truly, it is one of the wonders of the modern world.

FOREWORD

By GOVERNOR GEORGE H. DERN



THIS publication undertakes to recount briefly what has been accomplished in the utilization of Utah's minerals and to indicate what may reasonably be anticipated for the future. It is commended to the consideration of those desiring facts from authoritative sources.

The importance of Utah as a mineral producer, which is convincingly shown by the information herein, is evidence of the perseverance and skill with which the industry has been developed and operated as well as of the extent of the resources.

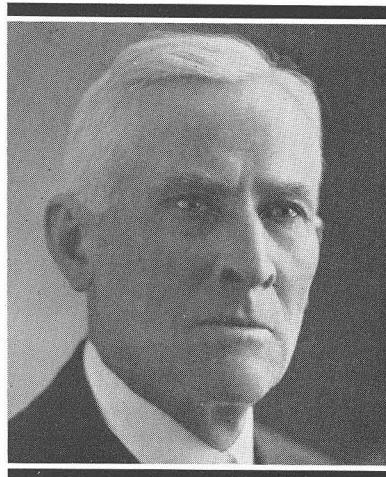
We do not yet know definitely how varied and extensive our mineral resources are, but we know they are many and vast. We have progressed sufficiently to be assured of their abundance and that means will be devised to make them available as needed.

The industry is of great value to Utah in many ways, besides the wealth it produces directly. It constitutes a very large home market for the other products of the State, employs large numbers of persons, furnishes the basic tonnage that made it possible to bring modern transportation to many portions of the state and is a very substantial contributor to the public revenues.

It will unquestionably be a factor in the further advancement of Utah.

THE ROMANCE AND LURE OF GOLD

By ANTHONY W. IVINS
of the First Presidency of the Church of Jesus Christ
of Latter-day Saints



WHO first introduced mining as one of the occupations of man we do not know. It is a fact, however, that the collection of gold and silver, and its use as a medium of exchange dates back to the earliest periods of the existence of man upon the earth.

Before Adam was placed in the Garden of Eden we are told that the river Pison, which flowed out from Eden, compassed the whole land of Havila where there was much gold, and that the gold of that land was good.

The Bible tells us that there are veins for silver, but that gold is where they find it. This condition still prevails, as every old prospector well knows.

More than four thousand years ago, according to our chronology, Tubal Cain, the son of Zilla, was an instructor of all those who worked in brass and iron.

The value of gold and silver as a circulating medium was recognized at a very early period in our history. It is recorded in Genesis that Abraham was very rich in cattle, silver and gold. Upon

the death of his wife Sarah, he bought from Aphron the field of Mac-pe-lah, and the cave that was upon it to be used as a burying place for his wife, "and he weighed out to Ephron, the son of Zohar, four hundred shekels of silver, current money with the merchants." About two hundred fifty-six dollars.

The use of copper was also known anciently. Ezra refers to vessels of fine copper which were precious as gold.

King Solomon built ships and launched them on the Red sea, which sailed away to the land of Ophir and after three years returned bringing four hundred twenty talents of gold, and also ivory, spices, sandal wood and monkeys. The Bible tells us that during his reign Solomon made gold and silver as plenteous as stones in Jerusalem.

From the time of King Solomon to the present, mining has been one of the most important occupations of man. Agriculture alone may be considered of greater importance. Food to sustain the body, clothing with which to cover it are in-

dispensable to our existence, and both of these may be obtained through the cultivation of the earth, and the tending of flocks and herds.

Mining is the most fascinating occupation in which man can engage. Once the enchantment of its charm possesses a man it holds him captive forever. Whether it be the solitary prospector who sits alone by his camp fire in the hills or on the desert, or the operator who takes the base ore and extracts from it the gold, the silver, copper and lead and sends the refined product forth to add strength to the commerce of the world, he becomes entranced with his occupation.

The miner takes from the earth the treasure which is hidden in her bosom and thus adds new blood to the circulating medium which is the life of the commercial world. Can any occupation be more honorable, more praiseworthy?

The romance and tragedy of the lure of gold cannot be told in a short article such as this, and the mining industry in Utah has provided its full quota of both. The romance of the discovery of her mines, the early efforts in their development, the millions of wealth taken from her hills, the dangers and disappointments which have followed many of the brave men who struggled for the accomplishment of ideals which were never realized, if told would read like a fairy tale, or one of Shakespeare's tragedies.

The lost mines which are scattered over every state in the west, and on to the south through Mexico and Central America have drawn many courageous men to their death. Where is the great deposit of gold found in Montana in 1864 by Captain James L. Fisk and Dr. William Denton Dibb, from which they were driven by Indians, the Lost Cabin mine of Wyoming, the Rhoads mine in the Uintas, the Lost Lead discovered by Jim Houdon on the old Spanish trail in south western Utah while on his way to the gold fields of California, and which he returned from Australia forty years after to locate but could never find?

Where is the Bryfogle mine, somewhere in the neighborhood of Death Valley; the Gunsight mine in the same neighborhood? Where is the Peg Leg mine, somewhere between the Salton Sea in Arizona and the mouth of the Colorado; the Planchas de Plata, which actually existed in the same region from which plates of silver weighing hundreds of pounds were taken? Where is the Tyaopa for which the writer has searched in the Sierra Madres of Mexico?

Whether these lost mines ever existed or not the stories of them appear to be so well founded that scores of men have lost their lives in the search for them.

When two tired and penniless miners sat by an old prospect hole in Australia and after discussing their hopeless condition decided to sink through the gravel to bed rock hoping that they might find gold enough to replenish their scanty stock of supplies; when one of them struck his pick into the gravel where it stuck fast, and in a few moments they unearthed the Welcome Nugget, the largest piece of pure gold ever found, a nugget which made both rich, there was real romance in it.

Was it not romance when Pauline Weaver pointed out to Jose Redondo the place where he had found placer gold in Arizona and Redondo from the first shovel full of gravel washed forty dollars worth of gold, and later found one nugget worth nine hundred forty dollars? On Rich, or Antelope Hill nearby, a man, with only a hunting knife for a tool took out four thousand dollars in a single day.

These are only a few of the many historical facts which illustrate romance of the lust for gold.

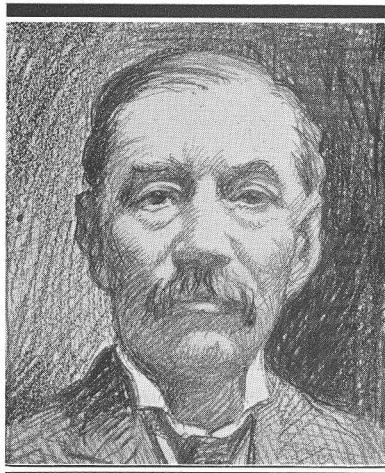
Have all of the mines been found? Emphatically, no. We have only discovered those which exist where surface indications give evidence of their presence. Hidden beneath the surface of the earth are vast deposits of treasure which will yet be discovered, and opened to add their wealth to the millions which have already been taken from the hills of Utah.

PROMINENT IN UTAH MINING HISTORY



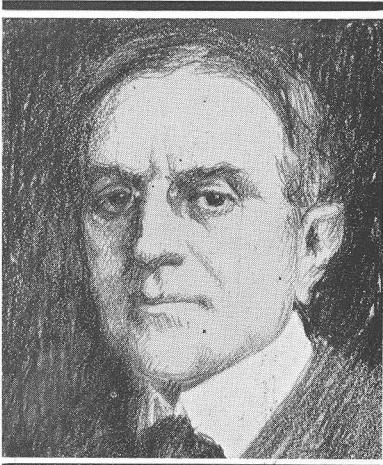
DANIEL C. JACKLING: 1869—

Probably best known of Utah's many famous mining pioneers; a fame well founded on great foresight and superb knowledge of mining problems. Made possible the mining of a great mountain of copper ore so low in metallic content as to be universally pronounced "worthless" as a mining possibility. It can be rightfully said that Mr. Jackling "made Utah when he made Utah Copper."



ENOS A. WALL: 1839—1919

A pioneer in many of Utah's well known mining camps. Rightly called the "Father of Utah Copper" as it was his original holdings in the Bingham Canyon district which later became the nucleus of the world's premier copper producer. Colonel Wall was known for his inventive ingenuity. His talent, fatherly advice, and financial aid were freely given to students of mining, metallurgy and engineering.



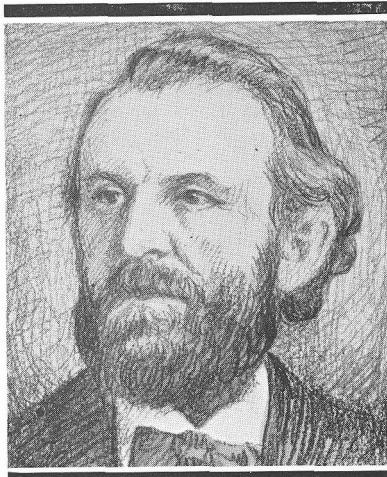
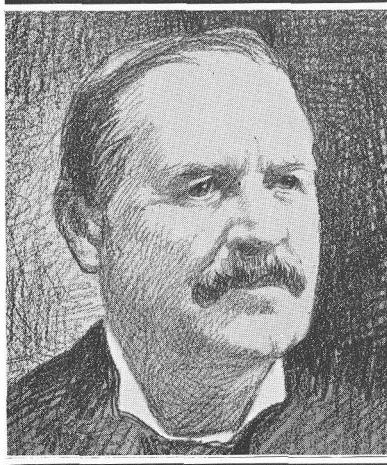
SAMUEL NEWHOUSE: 1853—

Indefatigable in bringing millions to Utah for investment in metal mining enterprises and one of the first to recognize the potentialities of the so-called "copper porphyries" of Bingham Canyon. A great benefactor and builder; gave to Salt Lake City its first "skyscrapers" and donated the site for the Chamber of Commerce and the Mining Exchange. Resides at present in Paris, France.

PROMINENT IN UTAH MINING HISTORY

JOHN DERN: 1850—1922

Father of Utah's present Governor. As founder of the Consolidated Mercur Gold Mines Company, one of the state's early bonanzas, and through activity in other mining districts he became known as one of Utah's leading mining pioneers. His interests covered a broad scope, touching the general welfare of society as well as the development of the material wealth of the state. One of the great men of his time.

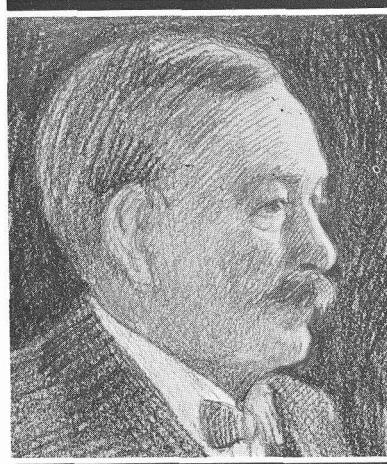


WILLIAM S. GODBE: 1833—1902

One of the first of Utah's leaders in the development of her mineral wealth. His activities extended over many of our western states but centered in the famous old Ophir district which was destined to gain world wide fame for the fabulous wealth taken from its mines. Mr. Godbe was directly responsible for the erection of early mills and smelters in all the principal districts of the state.

THOMAS KEARNS: 1862—1918

One of "the old Park City Bunch," constituting some of the most outstanding figures in Utah's mining history. With David Keith he became associated in the development of the famous Silver King property which has since become one of the greatest silver producers in the world. It was "the bunch" under the leadership of Senator Kearns, that made Park City famous. A man of great ability.



MINING IN UTAH

Historical¹

THE Mormon Pioneers settled in Utah in 1847. By 1852 they had discovered coal, iron, and non-ferrous deposits and had produced sufficient quantities of material for local needs. However, the mining industry of Utah of today had its inception in the chance discovery, by a soldier prospector, of a galena boulder. The discovery was made in the district which is now known as Bingham. That was in 1863, sixty-seven years ago. George B. Oglivie was the name of the soldier prospector.

Like all things of a permanent nature, the growth of Utah's mining industry has been steady. As was to be expected, at first every outcrop was looked upon as a bonanza and prospectors felt sure they would soon be millionaires. Beginning with that September day in 1863 when the first mining claim to be located in the State of Utah was staked out and christened the "Jordan" by Oglivie and his comrades, the mines of Utah have produced, up to January 1, 1929, gold, silver, copper, lead, and zinc having a value of \$1,610,514,947 and have yielded \$312,842,664 in dividends.

As has been true of the development of most of the great mining districts of this country, Utah owes the development of its mining industry to a group of remarkable characters, outstanding among whom was General Connor, brilliant soldier and veteran Indian fighter, who was in command of the United States troops stationed in Utah in 1863 at the time Oglivie made his discovery, and who has been honored by later generations as "The Father of Utah Mining."

Today the mineral resources of the State of Utah have been developed to a point which places it among the three or four most important metal mining states in the Union. Such a ranking in a state of only 552,000 population, according to the 1930 census, indicates that its mining in-

dustry is a vital element in its economic life. In fact, it employs about one-third of the total number of employes carried by the State Industrial Commission, produces about one-third of the new wealth annually created in the State, and supplies four-fifths of all the railroad tonnage of Utah.

In actual figures, the output of Utah's mines is valued at about \$120,000,000 annually.² Of this gross value, approximately \$85,000,000 is immediately expended, largely within the state, for wages, freight, smelting, and supplies. Thirty million dollars of this is spent for labor at mines and smelters. The stockholders of the mining companies received, in 1929, approximately \$38,167,318 in dividends, which was the largest dividend ever paid in the history of the State. The mining industry is, indeed, therefore, one of the most important factors in Utah's present economic structure.

As has been said, a study of the sources of wealth of a country or a section of a county is very informing. If the study is carefully and properly made, it reveals the actual means of subsistence of the inhabitants of the area covered. Furthermore, it not only reveals the industries and the importance of each, but also the relative importance of the several industries to the inhabitants.

To say that Utah is fortunate in possessing such large mineral deposits, developed and undeveloped, and the industries built upon them is to say a thing that everybody within the state knows. A more important thing to know, however, is that

¹Anyone desiring further information concerning the history of mining in Utah may obtain the same by addressing the Secretary of the Mining Committee of the Chamber of Commerce, Salt Lake City, Utah.

²What Mining Means to Utah—Publication of the Chamber of Commerce of Salt Lake City, Utah.

the mining industry provides employment directly for approximately 17,000 persons resident in the state. The economic and social welfare of these men and their families is dependent upon mining and industries directly built upon it. A survey of some of the mining towns seems to indicate that the national figure on size of family holds good for these particular towns. If it holds true that for every wage earner 4.3 persons obtain their livelihood, it means that about 70,000 persons are directly dependent upon the mining industry for a living.

When we add to this those indirectly dependent upon the industry, it brings the number considerably higher. This, of course, refers to the tradespeople, for almost all of the enormous annual payroll of twenty-eight and a half million dollars finds its way to the channels of trade.

There are, however, others besides the tradespeople who are indirectly dependent upon this industry. The electrical industry in the state is a large and growing one, and employs a considerable number of persons. The mining industry

consumes a very large percentage of the power produced. In fact, it is the largest consumer of electrical power in the state. Likewise, the mines, through their products, furnish the railroads a very large part of the intrastate traffic, and the railroads in turn employ hundreds of men to handle this freight. While in the two cases involved—electrical power and freight transportation—it is almost impossible to determine the exact number (due to the complexity of the industries) who are employed, it doubtless runs into thousands and constitutes a considerable and important part of our population.

Mining is, therefore, one of the very foundation industries of the state, and its importance cannot be over-estimated.

This summary indicates Utah's importance as a mining state:

	1929 Production	Proportion U. S. Total	Rank
Gold	\$ 4,803,000	10.41%	4th
Silver	17,749,000 oz.	29.41%	1st
Copper	320,193,000 lbs.	13.58%	2nd
Lead	286,817,000 lbs.	22.15%	3rd
Zinc	100,400,000 lbs.	6.86%	5th
Valuation	\$ 96,485,000	14.19%	

UTAH'S LEADING MINING DISTRICTS^{3, 4}

UTAH has three principal mining districts, namely the Bingham District, the Park City District, and the Tintic District. From time to time several districts of the state have been important producers, as for example:

THE FRISCO DISTRICT in Beaver County, in which is located the Horn Silver Mine, which has to its credit a total production of \$50,000,000 from a block of ground 1000 feet long, 400 feet wide and 1000 feet deep.

THE ALTA DISTRICT⁵ in Salt Lake County, the producing mines of which were the Prince of Wales, the City Rocks, the Grizzly, the Flagstaff, and the Emma, which in their day were producers of bonanza rock, and in recent years the Cardiff which has paid out approximately \$1,075,000 in dividends. Twenty-four sep-

arate companies previously operating in the Alta district have been merged into one company known as the Alta Merger Mines Company. The holdings of this company consist of 99 mining claims, aggregating 1,400 acres of mining ground in one contiguous block. There has been produced to date from property now owned by the Alta Merger Mines Company more than \$4,000,000 worth of silver, lead, copper, and gold ores.

³ Mining Districts and their Relation to Structural Geology, by J. J. Beeson. Transactions of American Institute of Mining and Metallurgical Engineers, No. 1500-I.

⁴ Mineral Resources of U. S., by U. S. Bureau of Mines.

⁵ Geology of Cottonwood District, Utah, by B. S. Butler, G. F. Loughlin and V. C. Heikes, U. S. G. S. Bulletin No. 620-I.

THE SILVER REEF in Washington County, discovered in 1874, and which has been termed one of the most famous ghost camps of the west, having to its credit a production of \$7,987,142.

Other districts which have, in the past, been producers are the Gold Hill, West Tintic, Marysvale, Ophir, Boxelder and Grand Counties. Although the output of these camps in late years has been small, work is nevertheless being continually carried on in these districts and companies doing work in them are confident that with further development work, based on the knowledge which will be obtained from careful geological work, practically all of these districts will again become important producers.

BINGHAM⁶

HISTORY:

The first mining claim to be located in the state was staked out in this district, by Oglivie and his companions and christened the "Jordan." As before stated, that was on September 17, 1863. Three months later to a day, the West district was organized. The following year placer gold was found in Bingham Canyon and the now famous copper district began life as a gold camp. Lack of transportation facilities and reduction plants handicapped development so that the original discoverers profited little by their luck. As distances to railroad and smelter became reduced by the slow advance of the outposts of civilization, the output of silver-lead mines was increased.

LOCATION:

The Bingham District is in Salt Lake County and is located about 30 miles from Salt Lake City in a southwesterly direction. There are two railroads into the district, the Denver & Rio Grande Western and Bingham and Garfield, the latter being the property of the Utah Copper Company and is used by the company in delivering the ore from its mines to its concentrating plants at Magna and Arthur. The Bingham Stage Lines

also operate between Salt Lake City and Bingham Canyon, with frequent service.

ORES:

Two different types of ores are mined in the Bingham District. One type embraces ores carrying an intimate association of silver, lead and zinc. The other type consists of those ores in which copper is the predominating metal.

MINES IN DISTRICT

Among the mines which produce principally silver, lead, and zinc are the United States, the Utah Apex, the Utah Delaware, the Utah Metal and Tunnel, the Bingham Mines, and the Bingham Prospect. The Utah-Apex is the deepest mining operation in the state. The lowest workings are over 4000 feet in vertical depth and the lowest level, the 3100, is reached by an inside underground shaft which extends below the 2400 ft. level.

The Utah Copper Company:

The Utah Copper Company is individually the peer of all the copper mines of this country. In fact its achievements have been so outstanding that it was given a special mention in an editorial in the August 20, 1927, issue of the Engineering and Mining Journal. The editor starts his editorial with the following: "The Utah Copper Mine today can be ranked as the premier copper mine." The article goes on to state that while the Kennecott Copper Company owns 95% of the Utah Copper Company's shares, that Kennecott without Utah would be like a handsome automobile with five of its eight cylinders missing fire. For the Engineering and Mining Journal to single out in its editorial columns any one mining company and call it "the premier" is unusual procedure. It is, however, a glowing tribute to the organization.

⁶Those interested in the geology of the district and in its ore deposits are referred to U. S. G. S. Professional Paper No. 111, in which is contained a bibliography of the Bingham and other districts of the State.

Present-day large scale copper operations had their inception when in 1903 Colonel Jackling began laying plans for working the huge deposits of low grade ore at Bingham by steam shovel and open cut mining. The properties of the late Colonel E. A. Wall, a pioneer of Ophir, Bingham and Mercur were secured for the Utah Copper project, then considered wholly visionary and impractical. How well the Jackling enterprise has succeeded is now a matter of history. Records show that the Utah Copper has paid a total of \$203,481,102 in dividends. During 1929 the mine produced 306,527,513 pounds of copper, yet it has many years of activity ahead of it, as indicated by the fact that during 1929 an aggregate of 5075 feet of churn drilling developed additional positive ore amounting to 15,000,000 tons with an average grade of 1.12% copper. Indications are that the probable ore will amount to an additional 20,000,000 tons with a grade of about 1% copper. The total ore reserves as of December 31, 1929, as they will be mined amount to approximately 640,000,000 tons averaging 1.07% copper. To date there has been mined 193,868,751 tons. Drilling operations will continue for several years with every assurance that additional ore will be developed.

In the year 1927, as in the year 1926, the Utah Copper Company held the ranking position of all companies from a standpoint of production. In 1927 it produced 90.7% of all the copper mined in the state. In the year 1928 this company produced about 15% of the United States total, and since the United States, during that year, produced 55% of the world's refined copper, it can safely be stated that in 1928 this company's output represented about one-twelfth of world production.

During 1929 a record production of 17,724,100 dry tons of ore was mined and transported to concentrating mills, this being an increase of 1,165,600 tons over the 1928 tonnage.

The total of ore treated at the concentrating mills at Garfield was 17,724,100 dry tons, about equally divided between the Arthur and Magna plants. This is equivalent to 50,210 tons per day for the 353 operating days in the year.

The average copper content was .994% or 19.89 pounds per ton, as compared with .992% and 19.84 pounds, respectively, for the year 1928. The average recovery in the form of concentrates was 85.67%, or 17.04 pounds per ton, as compared with 85.56% and 16.97 pounds, respectively, for the year 1928.

The average milling cost for 1929 was 36.58 cents per ton, as compared with 36.9 cents for the year 1928, a decrease of .32 cents per ton. The concentrates shipped to the Smelter contained 302,013,015 gross pounds of copper, the average grade being 32.06% as compared with 281,077,725 gross pounds and 31.53%, respectively, for the year 1928.

The meteoric waters which percolate through the vast dumps of stripping or overburden, generally referred to as waste dumps, dissolve a minute percentage of copper. These solutions were collected in conduits and pipe lines and conveyed to a central precipitating plant where 4,420,460 net pounds of copper was recovered at a cost of approximately 6.5 cents per pound.

During the year 1929 the electrification of the mine haulage system was continued by the addition of thirty eighty-five-ton electric locomotives, making a total of forty-one now in service. Steam locomotives are now in use at the mine only on some of the upper levels where the greater part of the material handled is short haul stripping. To furnish power for the additional locomotives, eight 1000-Kilowatt rotary converters with the necessary transformers and switching apparatus were installed.

The Ohio Copper Company:

Another producer of copper in the Bingham District is the Ohio Copper Com-

pany of Utah, which after several years of unprofitable mining and milling of its low grade copper ores adopted, in 1923, leaching and precipitation as the method of extracting the copper and which still is being successfully carried on. This system consists of distributing a slightly acidified solution over the surface of the old stopes containing a large tonnage of low grade ore through which it percolates and becomes enriched with copper. The copper solution is then collected in the Mascott Tunnel 1100 feet below the surface where it is conducted through launders containing light scrap iron. The copper carried in solution replaces the iron forming a high grade cement copper or copper mud which is shipped to the Garfield plant of the American Smelting Refining and Mining Company.

For the past two years extensive exploration work has been carried on in the limestone deposits underlying the property at depth below the Mascott Tunnel, with a view to developing the copper-gold and lead-silver ores known to exist under similar conditions in adjoining properties.

PARK CITY⁷

HISTORY:

The early pioneers who herded their cattle and sheep on the hills of the Park City District little dreamed of the vast wealth in silver and lead which lay concealed beneath the grass-covered slopes. They looked upon the region as one valuable for its meadows and timbers, and had no idea that the stately trees covering the hills would reverse positions and, as mine timbers, support the earth which then supported them.

Although sporadic attempts to mine date back as far as the Walker and Webster Claim in 1869, real mining activity began with the discovery of the Ontario by Rector Steen, a soldier prospector of mining experience in California who had enlisted for service in Utah because the mountainous character of the country led him to believe that minerals could be

found in the Territory. Steen did considerable prospecting with but little success. But on June 15, 1872, he happened to see a knob of ore sticking up out of the ground. An assay proved the rock to carry from 100 to 400 ounces of silver to the ton. Steen staked out the Ontario and began mining the ore body which was to produce over \$50,000,000 in silver, lead, and gold. Other great mines were then opened up and Park City soon assumed a position as one of the leading mining camps of the West.

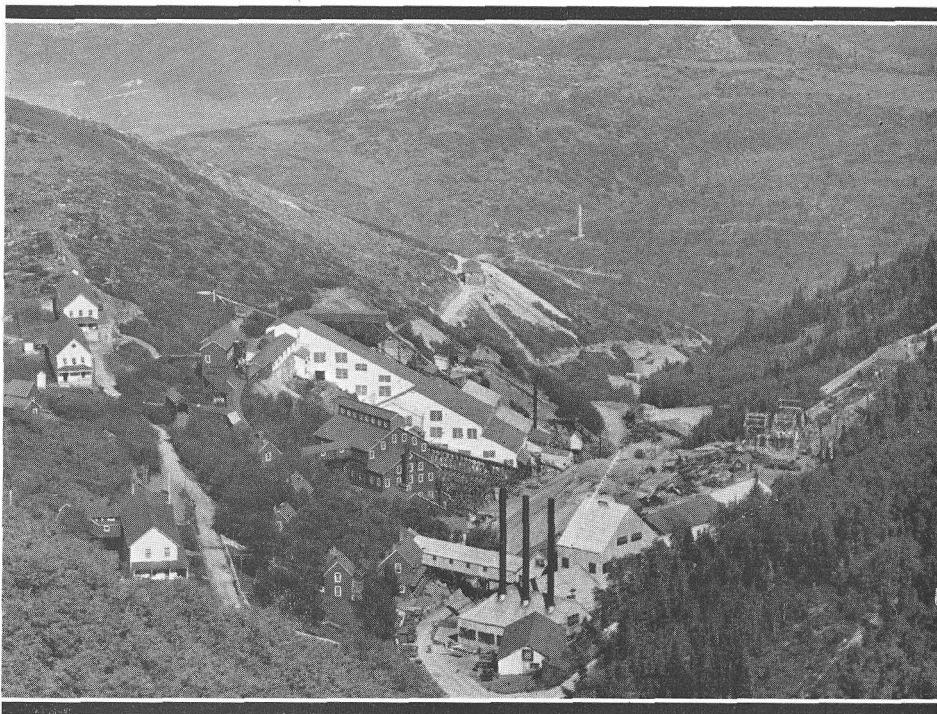
LOCATION:

The Park City District is in Summit County and is located about thirty miles east of Salt Lake City. Both the Denver & Rio Grande Western and the Union Pacific railroads operate trains into the district, which haul the rich ores out. Stage lines also run between Salt Lake City and Park City, furnishing regular and frequent passenger transportation.

ORES:

The ores of the Park City district occur as lode and as bedded deposits in sedimentary and intrusive country rocks. The two types of deposits are commonly associated throughout the region, though some lodes and veins occur alone. The lode deposits are extensive, strong and valuable. They lie in a few continuous master fault zones, rather than in a large number of small fissures. These deposits may be characterized as argentiferous lead ores with some zinc and copper and a small amount of gold. The lead occurs as carbonates and oxides in the upper levels and as sulphides in the lower portions. The silver is associated with pyrite and galena. Lode ore of economic size and grade extend from the surface to depths of more than 2000 feet. In general the upper parts of these deposits have proved richest, the middle section has been of high grade, and the deeper portions larger but leaner.

⁷ Geology and Ore Deposits of Park City District, Utah, by J. M. Boutwell and others, U. S. G. S. Professional Paper No. 77.



Silver King Coalition Mines, an Outstanding Producer in the Park City District

MINES IN DISTRICT

The leading producing mines of the Park City district are the Silver King Coalition Mines Company, Park Utah Consolidated Mines Company, the New Quincy Mining Company, and Park City Consolidated Mining Company.

Silver King Coalition Mines Co.:

The property of the Silver King Coalition Mines Company, and of its predecessors has been under constant development since 1882, and now consists of nearly 4000 acres of mineral-bearing land. Since that date to 1930 it has produced gold, silver, copper, lead, and zinc of a gross value of \$90,746,140. These metals were obtained from 1,677,724 tons of ore. From this total there has been expended for wages, supplies, materials, taxes, freight, treatment, and other necessary costs, the sum of \$60,979,088, all of which has gone into the channels of industry. The company employs about 725

men. The ore reserves of this company are reputed to be larger than at any previous time in its history.

Park Utah Consolidated Mines Company:

The properties which now constitute the Park Utah Consolidated Mines Company have been under constant development since 1872, at which time the Ontario-Daly lode system was first discovered. At that time the ore from the tunnel which was started from the bottom of the canyon averaged \$250 per ton. From 1872 to December, 1876 the property had yielded \$1,100,000.

When the Ontario property began to show its great value the claims immediately to the west were taken up by J. J. Daly. In February, 1885, the Daly Mining Company was formed. The organization of the Ontario and Daly companies has been in part identical, and they have conducted their operations in conjunction.

The properties of the company are fully equipped to handle approximately 1000 tons of ore per day. The underground workings are tapped by three main transportation and drainage tunnels and five deep shafts. During 1929 the lowest level was extended from 1800 to the 1950 level in the search for the continuation of the ore bodies above. On the 1800 foot level the headings are being advanced in entirely new territory under conditions which give excellent promise of new discoveries of importance. In 1929 what is known as the City unit of the property produced 123,939 tons of ore, and its large underground territory continues to give every assurance of many years of major production.

In 1929 the company mined 300,931 tons of ore, containing 48,708,381 pounds of zinc, 40,784,284 pounds of lead, 1,229,-051 pounds of copper, 25,387 ounces of gold, and 2,759,678 ounces of silver.

New Quincy Mining Company:

From a prospect of nearly thirty years' standing, this property in the heart of the old district, in 1928, blossomed forth from a venture financed by assessments into a mine shipping 150 tons daily and netting a substantial profit, thereby proving that all the mines in Utah have not been found and that as the years go by, new properties will be discovered.

The New Quincy Mine is located about two and one-half or three miles south of Park City in the Uintah and Snake Creek mining districts, part of the property being in Summit County and part in Wasatch County. It is joined on the north by the old Daly West property and on the west by the Daly Judge, both of which are now owned by the Park Utah Consolidated Mining Company.

The property consists of 337.75 acres of patented ground very desirably located in the Park City formation along a strong fissure system. The property produced, during the year 1928-1929 some 49,580 tons of silver-lead-zinc bearing ore which had an average assay value of

Lead, 12.05%; Copper, 11.7%; Zinc, 15.1%; Silver, 23.24 oz.; Gold, .0315 oz.

The ore bodies are quite well depleted on the west side of the New Quincy ground but are being prospected to the east with favorable results. The Company recently purchased some additional mining ground known as Little Bell property, and this is being vigorously prospected with no particular results to date, as it was necessary to do some extra work to get to the proper formations. As this has been completed, the management is hopeful of opening up another high grade ore body which is characteristic of this particular section of Park City.

The ore mined on this property is shipped as a mill product, in order to recover the zinc, to the International Smelting Company's plant at Tooele, Utah. The ore is dropped down from the 1200 level of the Daly West and hauled through their transportation tunnel to the D. & R. G. and U. P. Railroads, both of which have spurs to the mouth of the tunnel.

Park City Consolidated Mining Co.:

Up to 1929 the part of the district in which this company is operating was not looked upon very favorably by engineers and geologists, but through the energies of geologists who maintained that the scope of the Park City district was not alone confined to Park City proper, the existence of bodies of rich silver and lead ore has been shown, and while the figures of shipments are not available, production has been satisfactory and the future seems to be very bright for the continuation of ore bodies to depth. In other parts of the Park City district, outside of the proven territory, development work is being carried on. Prospects are favorable.

TINTIC⁸

HISTORY:

Although the Tintic District began production modestly with little excitement

attending the first discovery, it has now developed into one of the greatest silver districts in America. Government records merely report that Steve Moore, a prospector, located the first claim, the Sunbeam, in 1870. History's seeming indifference to the importance of Moore's disclosure is easily explained. At the same time Moore made his important discovery in the Tintic District, strikes were the order of the day. Exciting discoveries were being reported from Alta, Park City, Bingham, Beaver County, Ophir, Silver Reef, and other places which have long since been forgotten.

Consequently, slow but steady growth characterized the development of this district. A month after Steve Moore had located the Sunbeam, two of the district's richest mines, the Eureka Hill and the Mammoth, were staked and by 1871 the camps of Silver City and Diamond, at the south end of the district, sprang up as a result of the discovery of rich ores in the porphyry. Development of the limestone followed somewhat slowly. As a matter of fact, the pioneers of Tintic activity thought so little of the limestone deposits, it is related that the Mammoth mine, later a producer of \$20,000,000, was traded for a herd of Texas cattle.

The building of a railroad into the district in 1878 stimulated activity, and one rich discovery after another was made. As time went on, the Eureka Hill, the Humbug, the Spy, the Centennial Eureka, the Gemini, the Swansea, the Godiva, the Sioux, the Iron Blossom, the Colorado Chief Consolidated and others poured forth a stream of rich ore.

LOCATION:

The Tintic District is located in Juab County about 90 miles south of Salt Lake City. Lines of the Union Pacific and the Denver & Rio Grande railroads run into the district and stages furnish frequent

passenger service to and from various points in the district.

METALS AND MINERALS:

The ore metals include silver, gold, lead, zinc, and copper. Much iron ore has been, and is being mined from the south end of the district and shipped to the smelters as flux. Also the Chief Consolidated Mining Company has several million tons of very pure limestone on its holdings which assays around 98% calcium carbonate which is being shipped to the smelters, sugar factories, and as burnt lime to the mills, etc. This district also has small deposits of Fullers Earth, which is of very good grade, in the southern end near the contact of the igneous and sedimentary rocks.

ORE BODIES:

The ore bodies in the south end of this district occur as veins, filling fissures in the monzonite intrusive and extend into the sedimentary formations; these veins predominate in that section. The camp of Silver City mines ores of this type. The ore bodies in the north end of the district occur as limestone replacements. The mines of Eureka, Mammoth, and Dividend are mining this type of ore.

MINES—

The leading producers of the Tintic district are the Tintic Standard Mining Company, North Lily Mining Company, Chief Consolidated Mining Company.

Tintic Standard Mining Company:

From 1917 to December 31, 1929, the Tintic Standard mine produced 47,693 ounces of gold, 35,937,932 ounces of silver, 361,553,421 pounds of lead, and 10,181,873 pounds of copper, and has paid dividends amounting to \$12,787,-247. This company alone produces approximately 10,000 tons of ore per month. From a prospect with only a few thousand feet of workings, the Tintic Standard has developed into one of the most successful mining corporations in the United States, with more than 80

⁸ Notes on the Geology of East Tintic, by G. W. Crane. Transactions of American Institute of Mining and Metallurgical Engineers, No. 1491-I.

miles of underground workings and several subsidiary mines purchased and being explored to perpetuate the enterprise.

North Lily Mining Company:

In 1924 the North Lily Mining Company's holdings consisted of seven undeveloped mining claims, whose only claim to merit was its proximity to the one productive mine, the Tintic Standard, in the East Tintic District. By acquiring the East Tintic Coalition Mining Company property in 1926, and several other properties since then, the North Lily has now become a very important producer, with an average production of more than 6,000 tons of ore per month.

During 1929 the East Tintic property produced 72,889 tons of dry ore. Metal production amounted to 33,168,854 pounds of lead, 492,796 pounds of zinc, 790,143 ounces of silver and 9,413 ounces

of gold. The company paid dividends amounting to \$795,550 in 1929.

Chief Consolidated Mining Company:

The Chief Consolidated No. 1 mine, which is the main producer of this company, has, since the date of discovery in 1909, produced 1,220,255 dry tons of ore, containing 89,615 ounces of gold, 31,839,135 ounces of silver, 294,876,734 pounds of lead, 464,892 pounds of copper, and 22,049,401 pounds of zinc. The company, since its organization, has paid \$3,654,519 in dividends and has acquired several subsidiary mines which are now important producers.

There are numerous producing mines in this district, including the Eureka Standard, the Eureka Lily, and others, practically all of which are controlled by the Tintic Standard, North Lily, and Chief Consolidated.

MINING DISTRICTS OF UTAH

The following is a complete list of the mining districts of the State:

Beaver County

1. Beaver Lake
2. Bradshaw
3. Granite
5. Lincoln (Jarlrose)
4. Indian Peak
6. Newton
7. North Star
8. Pine Grove
9. Preuss (Newhouse)
10. Rocky
11. Frisco
12. Stra
13. Washington

Boxelder County

14. Ashbrook
15. Lucin
16. Newfoundland
17. Park Valley
18. Promontory

Cache County

19. Boxelder
20. Paradise (La Plata)

Davis County

21. Farmington

Emery County

22. Emery (Lost Springs)
23. San Rafael

Garfield County

24. Coyote Creek
25. White Canyon (Hite)

Grand County

26. Little Grand
27. Miners Basin
28. Richardson
29. Wilson Mesa

Iron County

30. Gold Springs
31. Iron Springs
32. Pinto Iron
33. Stateline

Juab County

34. Detroit (Joy)
35. Fish Springs
36. Mona
37. Mount Nebo
38. Spring Creek
39. Tintic
40. West Tintic

- Millard County**
 41. Leamington (Oak City)
- Morgan County**
 42. Agenta (Mill Creek)
- 43. Morgan**
Piute County
- 44. Kimberly (Gold Mountain)**
- 45. Ohio (Marysvale, Gold Mountains)**
- Salt Lake County**
- 46. Big Cottonwood**
- 47. Hot Springs**
- 48. Little Cottonwood (Alta)**
- 49. West Mountain (Bingham)**
- San Juan County⁹**
- 50. Blue Mountains (Monticello)**
- 51. Bluff**
- Sevier County**
- 52. Henry**
- 53. Saline Creek**
- Summit County**
- 54. Uinta (Park City)**
- Tooele County**
- 55. Blue Bells**
- 56. Rush Valley (Stockton)**
- 57. Clifton (Gold Hill)**
- 58. Columbia**
- 59. Desert**
- 60. Dugway**
- 61. Erikson**
- 62. Granite Mountain**
- 63. Lakeside**
- 64. North Tintic**
- 65. Ophir**
- 66. Rush Valley**
- 67. Silver Islet**
- 68. Tooele**
- 69. Willow Springs**
- Uinta County**
- 70. Carbonate**
- 71. Green River (Club Ceerk)**
- 72. Spring Creek**
- Utah County**
- 73. American Fork**
- 74. Lehi**
- 75. Provo**
- 76. Santaquin**
- 77. Silver Lake**
- 78. Tintic**
- 79. Utah**
- Wasatch County**
- 80. Blue Ledge**
- 81. North Fork**
- 82. Rhodes Plateau (Woodland)**
- 83. Snake Creek**
- Washington County**
- 84. Bull Valley**
- 85. Harrisburg (Silver Reef)**
- 86. Tutsagubet**
- Weber County**
- 87. Sierra Madre**

⁹ Geologic Structure of San Juan Canyon, by Hugh D. Miser, U. S. G. S. Bulletin No. 751-D.

METALLURGICAL OPERATIONS

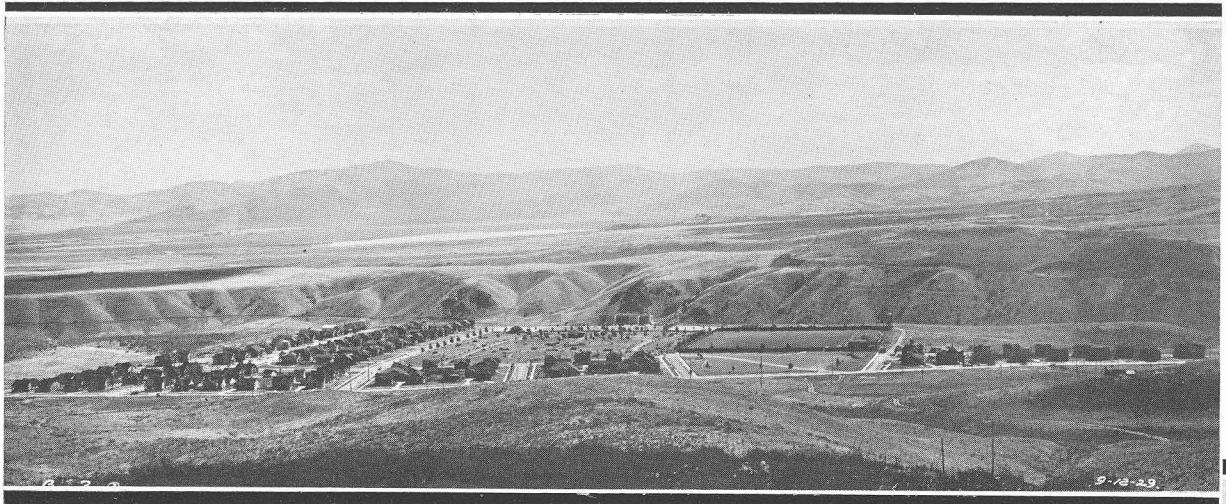
Copper—Lead—Zinc Mills and Smelters

THE district tributary to the Salt Lake Valley is Oregon, Idaho, Nevada, parts of California, Western Colorado, Wyoming, Montana, and Utah, thus making Salt Lake City and the adjacent valley a leading metallurgical center. All of the plants situated in the Valley are equipped with the most modern devices for the reduction of ores, and better mill or smelter practices cannot be found anywhere in the world. A prominent mining publication remarked a few years ago that if one could choose where to pick his mine the best place was in the Salt Lake Valley district, other conditions being equal, as there he could receive the best custom rates anywhere for treating

his ores. This is chiefly due to the fact that the reduction industry as a whole in this district realizes that in order to give itself long life it must follow a policy of making as great a return to the shipper of ore as is consistent with good business practice.

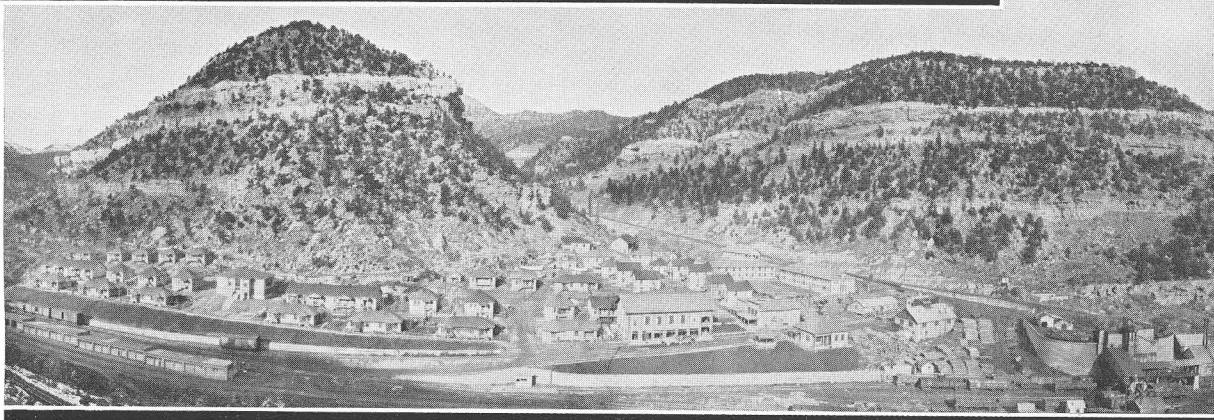
As is well known, most of the ores which are mined today in the several mining districts of Utah are too low-grade to be smelted direct. Hence, the ores as they come from the mines must first be subjected to a concentrating process in order to separate the metal bearing content of the ores, to such an extent as it may be commercially feasible to do so, from the non-metals, or gangue material.

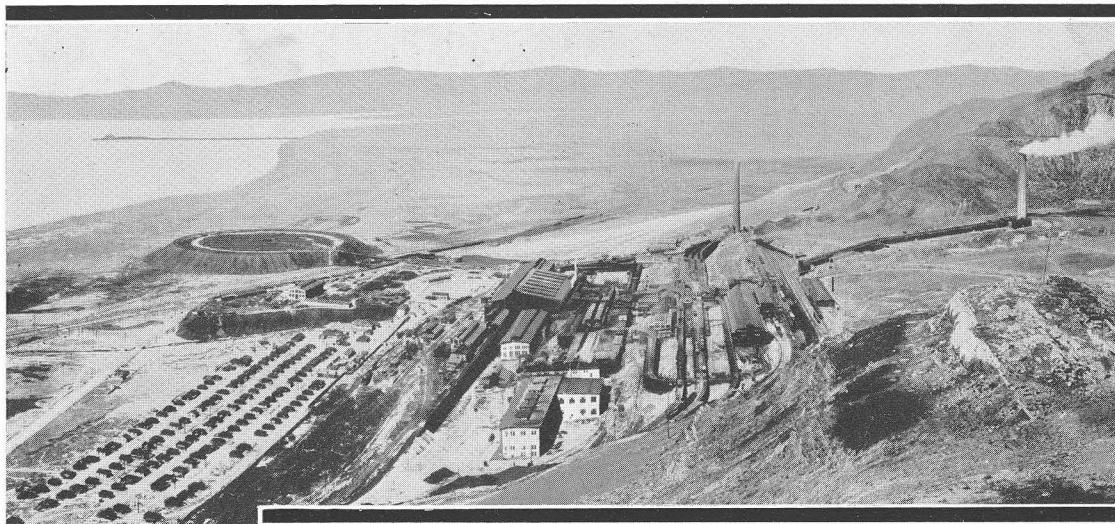
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Copperton, a modern home community at the mouth of Bingham Canyon, is a model in every respect. Homes are strictly modern, with lawns, flowers and garden plots. There is a baseball park and other recreational facilities here.

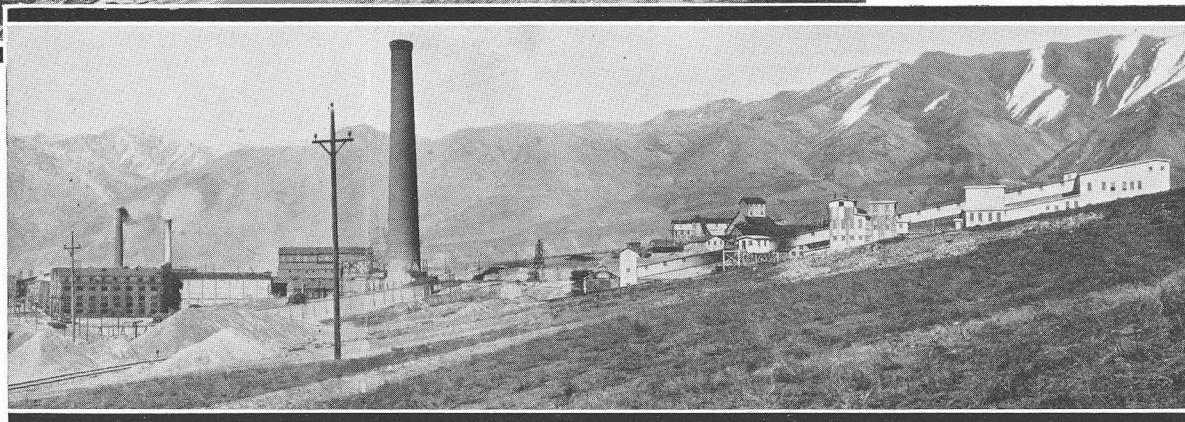
Standardville (right) is a representative mining town of Utah. Comfortable homes, good schools, club houses and modern recreational facilities make for good living conditions in Utah's mining centers.

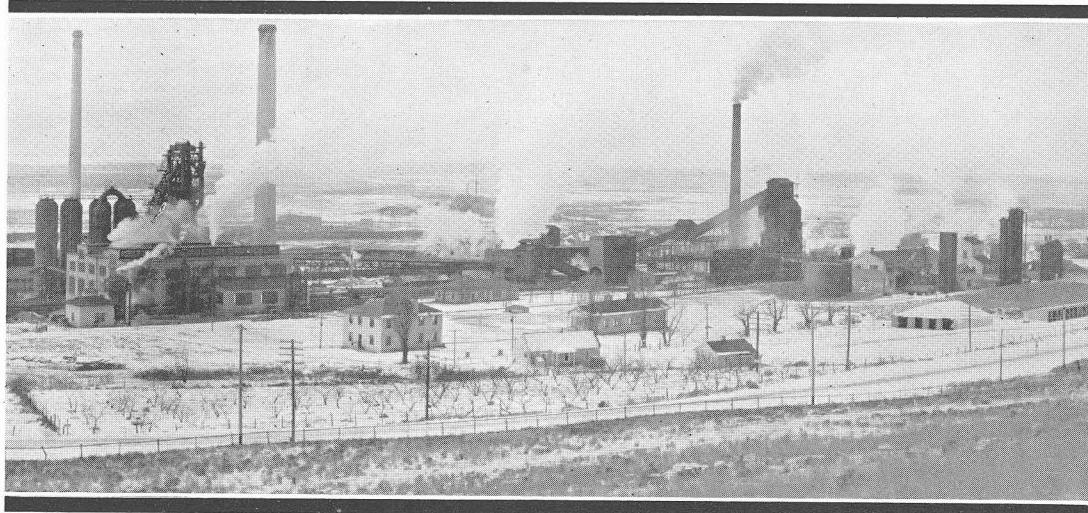




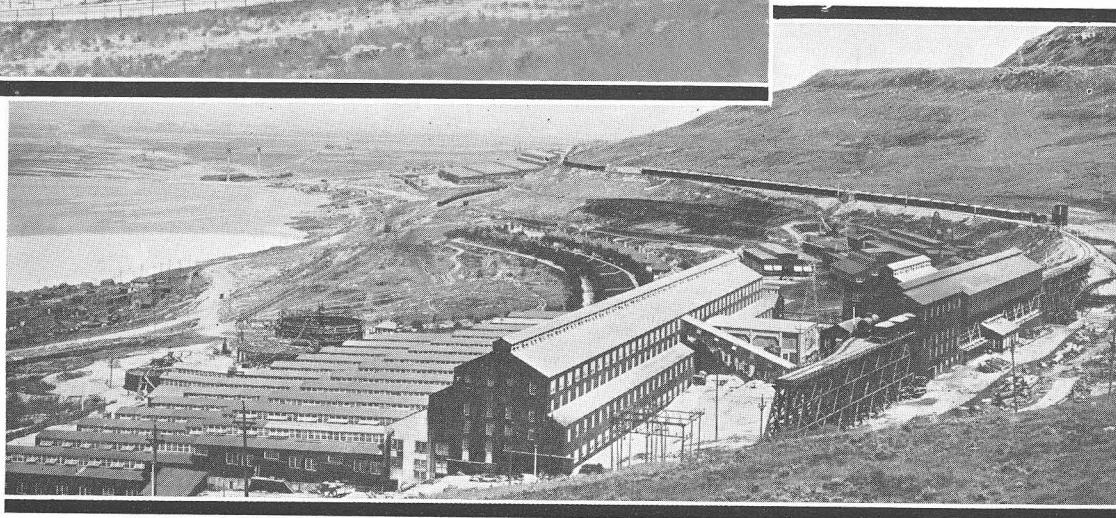
The Garfield plant of the American Smelting and Refining Company stands at the foot of the Oquirrh Mountains on the southern shore of Great Salt Lake. Here the copper concentrates from the Magna and Arthur mills are smelted, and the refined copper shipped to various parts of the world.

At Tooele, over the mountain from Bingham, the International Smelting Company maintains a flotation plant for the concentrating of the custom ores, and also a smelter for copper and lead. The picture at the right shows a section of this custom plant.





Near Provo, Utah, the Ironton plant of the Columbia Steel Corporation makes pig iron from Utah's vast iron ore, coking coal and limestone deposits. The capacity of the blast furnace is about 150,000 tons annually. The coke ovens produce approximately 300,000 tons per year. Adjacent to the blast furnace are a coal tar by-products plant and a cast iron pipe factory.



The plate at the right shows the Arthur Mill of the Utah Copper Company, with the same company's Magna Mill in the background. These mills take the low-grade ore and concentrate it to the point where it can be smelted. These mills handle the entire production of the Utah Copper mine, averaging approximately 60,000 tons a day.

(Continued from page 17)

For this reason, there is perhaps no place in the United States, due to the ability and enterprise of Utah's engineers, where concentration processes have been more highly developed than in the Salt Lake Valley. As is also well known, the flotation process is the process by which the majority of the ores, mined in the state, are treated in order to recover their metallic content.

By flotation, intimately associated minerals such as silver, lead, zinc, and copper occurring in one ore are separated for economical reduction to metals, by smelting. The ores treated are, for the most part, sulphide ores. However, due to improvements in the process and as a result of research and experimentation, it is now possible to recover the metallic values from oxidized ores, as well as sulphides, and custom plants for the treatment of such ores are now operating in the district.

Applied to the complex ores of Park City and Bingham, this process recovers nearly 100,000,000 pounds of zinc that formerly went to waste and makes better recoveries of the other metals than were formerly dreamed of. In the state as a whole, flotation has increased zinc production about five times. This has brought to the mines about \$6,000,000 more annual revenue, and an additional \$2,540,000 in freight to the railroad companies. Mining companies have been saved \$3,500,000 annually in lower smelter treatment charges by the elimination of zinc from their lead smelting ores.

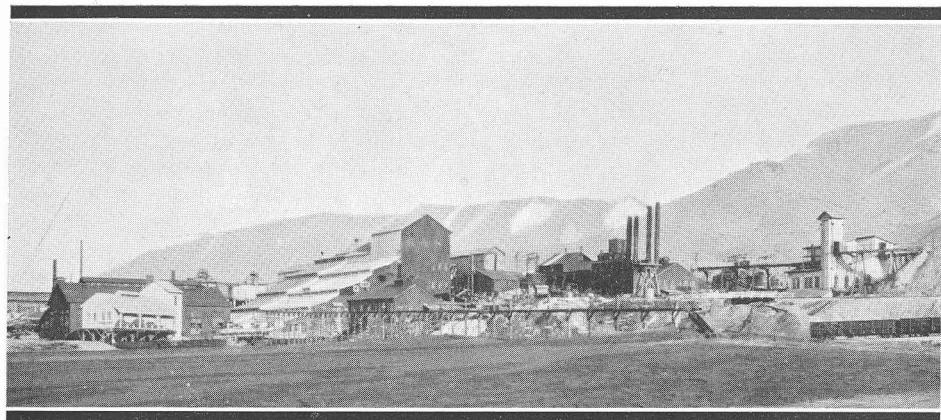
But the recovery of zinc is not the only benefit flotation has given the mining industry. It has made possible better milling practice in almost all classes of ore. The Utah Copper enterprise affords an impressive example of the application of the flotation process. Today it is one of the largest flotation plants in the world. During 1929, when operating at full capacity, this company mined on an average of 50,210 tons of ore per day. In 1905, when milling was first begun at

the Utah Copper, ore below 1.2 per cent in copper could not be treated and metal recoveries were less than 65 per cent. During 1929, the average recovery in this form of concentrates was 86.67 per cent of the metal values in ore carrying .994 per cent copper, or 19.89 pounds per ton.

The Utah Copper does not operate a copper smelter, but sells the concentrates from its concentrating plants to a nearby smelter. In addition to the Utah Copper Company, a number of Utah mines also own and operate their own concentrating plants. However, as the magnitude of the operations of many of the mines of Utah does not warrant their owning and operating their own concentrating plants, the ores from such mines are sold to custom plants. The three principal custom plants being operated at the present time are those of:

THE COMBINED METALS REDUCTION COMPANY at Bauer. This company's flotation plant was built in 1924, to handle 200 tons of ore daily from the Company's mine at Pioche, Nevada. The capacity of the plant was increased, in June 1929, to 450 tons and in March of 1930 to 800 tons daily. The plant is now treating custom ores from Utah, Idaho, Nevada, and Colorado, as well as the complex lead-zinc ore from the Company's mine at Pioche, Nevada. During 1929, the flotation plant produced 1,186 ounces of gold, 628,116 ounces of silver, 13,713,328 pounds of lead, and 26,450,715 pounds of zinc, with a net smelter value of \$1,569,073.17. The Company employs 225 men at its mine and mill at Bauer, Utah.

THE INTERNATIONAL SMELTING COMPANY at Tooele has erected flotation plants in which are concentrated not only the ores from its own mines in Utah and adjacent states, but likewise custom ores from these states. The lead and copper concentrates from the mills at Tooele are sent to the lead and copper smelting furnaces, which are operated by the Company at Tooele, while the zinc concentrates are for the most part shipped



At Bauer, Utah, the Combined Metals Reduction Company maintains a Concentrating Mill for Treatment of Custom Ores

to the electrolytic zinc plant of the Anaconda Copper Mining Company located at Great Falls, Montana.

THE UNITED STATES SMELTING, REFINING AND MINING COMPANY operates a 1000-ton mill at Midvale, in connection with their lead smelter at that place.

As before stated, the greater part of the copper and lead-zinc ores which are mined in Utah are first concentrated, for the purpose of removing as much as possible of the barren gangue material. At the present time there is no zinc reduction plant in the Salt Lake Valley. However, the following companies operate copper and lead smelters on a large scale:

AMERICAN SMELTING AND REFINING COMPANY. This company operates two smelters in the valley, namely a lead smelter at Murray, seven miles south of

Salt Lake City, and a copper smelter at Garfield, seventeen miles west of Salt Lake City. This latter plant treats chiefly the copper concentrates from the mills of the Utah Copper Company nearby and produces more copper per day than any other smelter in the world.

THE INTERNATIONAL SMELTING COMPANY operates a smelter at Tooele, forty miles west of Salt Lake City, at which are smelted both lead and copper ores.

THE UNITED STATES SMELTING, REFINING AND MINING COMPANY has a lead smelter at Midvale, 12 miles south of Salt Lake City. In addition to its mill and smelter the United States Company has an arsenic department, where weed killer and insecticides are manufactured. This arsenic, of course, is derived from the silver-lead ores which carry it in small quantities.

IRON IN UTAH¹⁰

In the United States, local manufacturing in iron and steel products has always followed closely upon development of iron ore deposits of sufficient quantity and quality to warrant its smelting. This being dependent upon suitable coking coal adjacent to such deposits.

For many years it has been known that

Iron and Washington Counties in Utah contained large iron ore deposits estimated by the United States Geological

¹⁰ Iron Fields of the Iron Springs and Pinto Mining Districts, Iron County, Utah, by Duncan MacVitchie. Transactions of American Institute of Mining and Metallurgical Engineers, No. 1468-I.

Survey at forty million tons, with other engineers estimating this at one hundred and sixty four million tons of ore in sight, with probabilities of there being up to one billion tons. Most of this is hematite ore averaging approximately 57% iron.

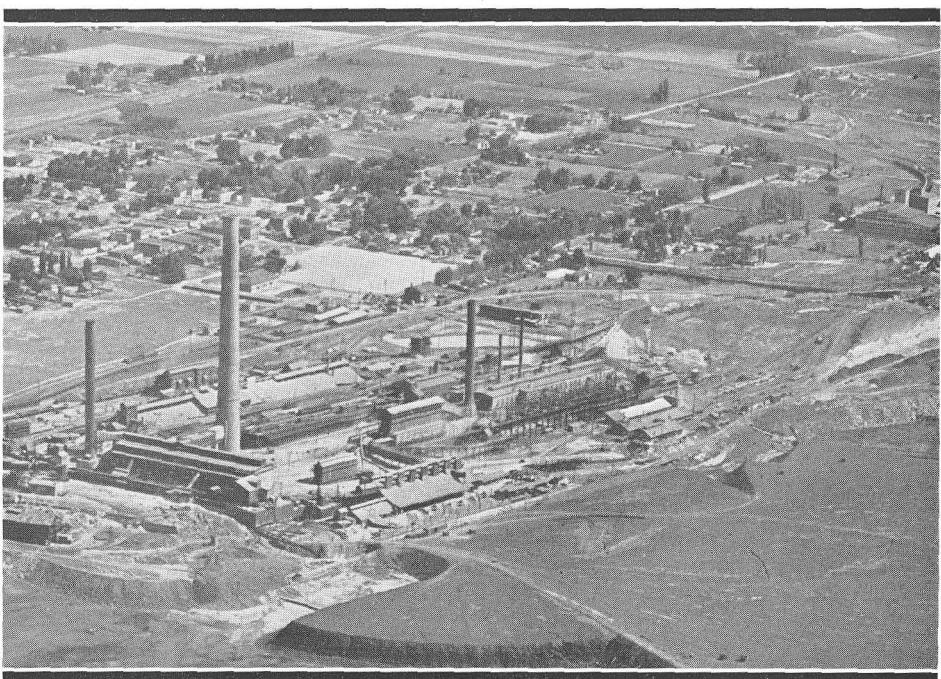
In Carbon County, Utah, large deposits of coking coal were found suitable for blast furnace operations. For many years these deposits lay untouched. In 1922 the Columbia Steel Corporation, a Pacific Coast enterprise, purchased large holdings of iron and coal deposits and erected at Provo, Utah, a blast furnace and by-product coke ovens. From their inception these operations have been successful and pig iron of superior quality has been produced. The capacity of this plant is approximately 150,000 tons of pig iron and 300,000 tons of coke annually.

At this same time the Republic Creosoting Company erected a plant to take the coal tar from the coke oven operations.

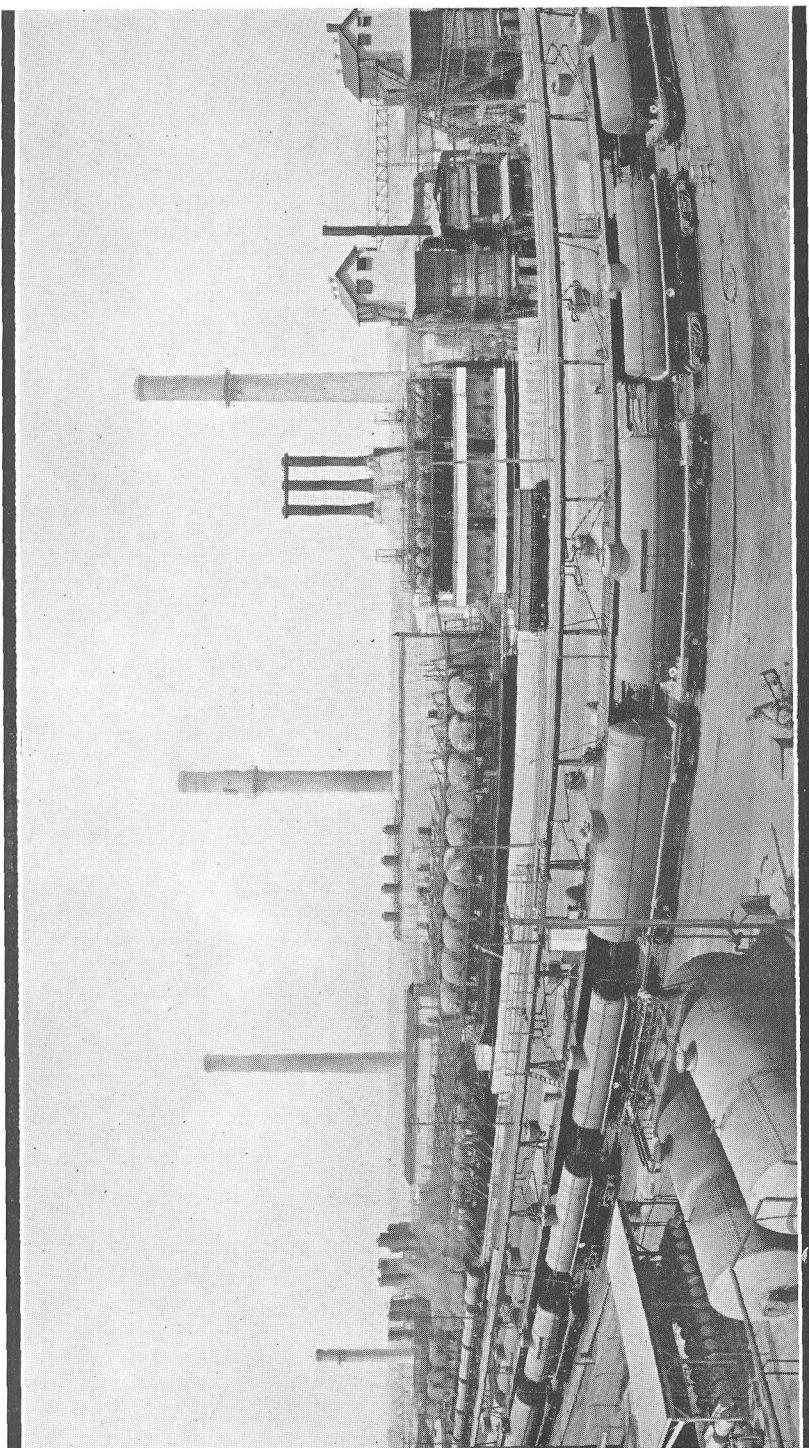
In 1926 the Pacific States Cast Iron Pipe Company erected a plant adjacent to the blast furnace and since that time has made very rapid growth.

The yearly pay roll of these plants is about one and one half million dollars, giving employment to hundreds of persons.

In 1929 the United States Steel Corporation became interested in the Columbia Steel Corporation, and early in 1930 took over their entire holdings, including finishing plants in Pittsburgh, and Torrance, California and Portland, Oregon. It is rumored that the United States Steel Corporation will materially expand these plants. This development is of great importance to the entire Pacific slope and, doubtless, large markets for finished products will be found in Russia and the Orient. Utah looks forward with confidence to that time, which now seems near at hand, when her iron and steel industries will be the basis for large industrial expansion.



Lead Smelter of the United States Smelting, Refining & Mining Company, at Midvale, Utah



The Salt Lake plant of the Utah Oil Refining Company is one of the largest industrial enterprises in the state. Crude oil is brought to this plant from Wyoming and New Mexico fields, and here refined into gasoline, motor oil, industrial and domestic lubricants. The plant represents an investment of more than \$5,000,000, and is one of the outstanding users of labor, material and transportation in the intermountain region. The company has been active in exploration work for the development of oil fields in Utah.

OIL POSSIBILITIES

ON account of the large mountain ranges traversing through the State of Utah consisting largely of the older rock formations and resulting, either on one side or the other, in what is termed a general depression of the beds without proper structural folding, and also a break-up of such possible folds in large gathering areas, Utah has not the numerous oil possibilities that such states as California, Texas, Oklahoma and Kansas possess. However, there are some possibilities of oil discovery in commercial quantities still remaining. Oil has been found in limited quantities at Cisco, Utah. At present several wells are being drilled in locations where the objective beds are petroliferous and might permit proper trappings or reservoirs for oil. The main objectives in this area are the Pennsylvania formations. If oil is to be found in commercial quantities, no doubt, the genesis of this production will be from the Pennsylvania shales which produced so prolifically for a very short time from the Cane Creek well, on the Colorado River, near Moab, Utah.

At Virgin, in southern Utah, there are quite a number of small wells on a monocline and the productive horizon is in the lower Moenkopi or the upper Kaibab formation. Therefore, east and southeast of this area there still remain certain possibilities for oil to be found in these same beds, but under more favorable structural conditions.

Accordingly, the Utah Oil Refining Company is drilling a well on the Butler Valley Structure, some 80 miles south of Marysville, Utah, and about 40 miles southwest of Bryce Canyon. If this well is a producer, no doubt other structures in that area will have equal possibilities.

In the meantime, however, crude oil, from the nearby Wyoming and New Mexico fields is brought to Salt Lake City for refining, by the Utah Oil Refining Company. This activity already con-

stitutes one of the foremost industries in the state, making Utah an important oil refining center. The plant is one of the most modern in the United States and furnishes employment to hundreds of Utah families.

North of the Great Salt Lake several wells are being drilled and the objective is the Pennsylvania. Showings have already been discovered and it is hoped that these operations will result in commercial production of oil.

The Boundary Butte structure, located in the southeastern corner of Utah, is now being drilled at 5,500 feet and the objective is the Pennsylvania sands, the equivalent of the Rattlesnake deep well producing horizon, some 40 miles away in the state of New Mexico.

Utah has great deposits of oil shales which eventually will be developed and commercialized. There has been, up-to-date, about eighteen billion barrels of crude oil produced since 1859 in the United States, and it is conservatively estimated by the U. S. Geological Survey that oil shales of Utah will eventually produce sixty to eighty billion barrels of shale oil.

No doubt the public is aware that the Germans have, for several years, been operating a process known as "Hydrogenation." The new process is the most remarkable chemical engineering development known to the great oil scientists of the world. It is capable of taking heavy tars, residuum from crude oil, heavy sulphur crudes, and even coal, and making high grade motor fuels and exceptionally high grade motor oils and other petroleum derivatives. Utah coal is especially adapted to this process. Those who have carefully studied the subject venture to prognosticate that within ten years this process will be established in a big way in Utah and it will result in the greatest industry within the state. The enormous possibilities are readily apparent.

COAL INDUSTRY

ALTHOUGH coal has been mined in Utah since the early pioneer days, the coal industry of the state is still in its infancy. With approximately one-sixth of the area of the state underlain with veins of coal of workable thickness, the United States Geological Survey estimates the unmined reserve at 196 billion tons.

While the deposits in the vicinity of Coalville, Summit County, probably were the first developed in a commercial way, the major development has occurred in the Carbon-Emery district, in the central part of the state, and from this area approximately 98 percent of the coal is mined at present.

At this time, veins under four feet thick are not considered commercial and approximately 70 per cent of the coal now produced is coming from veins ranging from eight to seventeen feet thick. The average annual production during the past ten years is about 5,000,000 tons. About half a million tons a year are converted into coke and the remainder goes on the commercial and industrial markets of Utah, Nevada, California, Idaho, Montana, Washington and Oregon, with small shipments eastward into Colorado, Kansas and Nebraska.

The Carbon-Emery coals are high-grade bituminous, as are those of some other districts as yet developed only by wagon mines. In the northern part of the state the coals generally are sub-bituminous. The Carbon-Emery coals are high-volatile, low in moisture, ash and sulphur and average around 13,000 to 13,500 British Thermal Units to the pound. In the same region as the high-grade commercial coals, also, are found the Sunnyside and Columbian districts, which are contiguous, that supply an excellent quality of gas and coking coal.

The principal producing companies are the Blue Blaze Coal Company; Chesterfield Coal Company; Independent Coal & Coke Company; Liberty Fuel Com-

pany; Lion Coal Company; Mutual Coal Company; National Coal Company; Peerless Coal Company; Royal Coal Company; Scofield Coal Company; Spring Canyon Coal Company; Standard Coal Company; Sweet Coal Company; Utah Fuel Company and United States Fuel Company.

The Utah Fuel has a big battery of coke ovens at Sunnyside and the Columbia Steel operates by-product ovens in connection with its blast furnaces at Ironton, Utah, near Provo.

The average value of the coal at the mines in recent years, on a run of mine basis, ranges from about \$2.50 to \$2.75 per ton, making the average production value about \$12,500,000 to \$14,000,000.

The average number of employees in the coal industry is a little in excess of 5,000, and the annual payroll is about \$7,500,000, although the industry furnishes the chief means of livelihood of approximately 25,000 men, women and children in the State of Utah. In addition to the wages paid, the coal industry spends in the neighborhood of \$2,500,000 annually for supplies; \$750,000 for power and taxes, and provides about \$15,000,000 a year in freight revenue for western railroads.

Adjacent to the mining camps are the towns of Helper and Price in Carbon County, which are bustling and wide-awake communities almost wholly dependent upon the coal industry for their income.

Generally, the mines are exceptionally well equipped. The installed tipple capacity is in excess of 14,000,000 tons per year, figuring 300 eight-hour working days. The average working period is about 200 days per year.

The Carbon-Emery region is served by two railroads—the Denver & Rio Grande Western and the Utah Railway, and the Coalville district is served by the Union Pacific railroad.

NON-METALLICS¹¹

A COMPLETE survey of Utah's non-metallic resources has not yet been made, but it is known that the State possesses great undeveloped deposits of non-metallic substances which await the establishment of new industries to effect their exploitation.

Utah's known resources of non-metallics, though in the primary stage of development, constitute several industries that are contributing materially to the importance of the mining industry and possess the basic requirements for practically unlimited expansion in the future as population and manufacturing in the West increases.

At the present time, the established industries are as follows:

SALT

Vast deposits of salt exist in Utah. Rock salt is mined from open-cuts in Sevier and Sanpete Counties, but the principal production of salt in Utah originates from the waters of the Great Salt Lake. This inland sea has an area of 2,250 square miles and is about 75 miles long and 30 miles wide.

In Utah all evaporated salt is made by what is known as the Solar Process—the sun does the work. The water from the Great Salt Lake, the contents of which range from 13% to 18% salt, is lifted several feet to a level where it then flows by gravity into large concentrating ponds of several thousand acres. The water is allowed to remain in these large ponds for several weeks, until the brine begins to concentrate. Before the salt begins to precipitate, the brine is conducted by gravity into the "solar vats." These vats are large earthen ponds some 25 acres in extent. The bottoms of the "solar vats" are pure salt, having been deposited in

previous years. The salt brine is allowed to remain in these vats during the summer, until much of the salt has precipitated. The remaining brine, or liquor, is drawn off quickly, before the undesirable solids which are in the original lake water are allowed to precipitate—the liquor being diverted back into the Great Salt Lake.

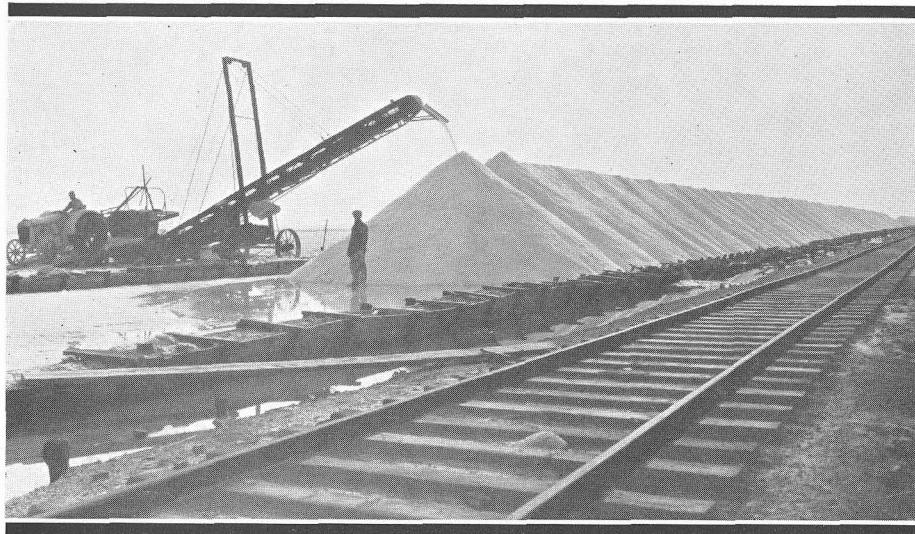
This leaves a deposit of several inches of salt which is practically pure, averaging over 99½% pure salt. This deposit remains in the ponds to dry until about the first of September, when the "salt harvest" begins. The salt deposit is then loosened up by plows drawn by tractors. Mechanical salt harvesting machines, drawn by tractors, are taken into the ponds and the salt is "piled" in long piles near the railroad track where it is allowed to "cure" during the summer. It is then loaded into trams and taken into the salt mill, where it is passed through enormous driers. It is then run through the crushers, rolls, screen, and automatic weighing machines, during which process it is made into the desired grade. There is manufactured in Utah a grade of salt for every possible purpose to which salt may be applied.

The salt production thus carried on in Utah amounts to approximately 80,000 tons annually, and has a value of about \$400,000.

OTHER SALINES

The utilization of the salines of the Great Salt Lake and of the Great Salt Lake Desert in Western Utah, other than salt, as for example calcium, magnesium, and potassium is a potential industry of the future. The Great Salt Lake Desert is one of the largest areas of potash-bearing salts in the United States. The salts are present in the strong brine solutions in the form of potassium chloride and in quantities averaging about 7 per cent or 3.5 per cent potassium. This is

¹¹ Utah has a greater variety of raw materials for manufacturing than any other state in the Union, and has a greater variety of minerals than any similar area in the world.



Harvesting the Salt Crop on the property of the Royal Crystal Salt Company, near Salt Lake City

about twice the concentration of the potash salts in the waters of Great Salt Lake. Brines are found in both the salt crusts and underlying mud; the solutions obtained from the mud at depth show over 25 per cent dissolved salts of which 3 to 4 per cent is potassium.

Magnesium chloride is present in slightly less quantities than potassium chloride and no doubt will be equally as valuable as the potash content if research in the production of magnesia metal proves true.

Due to the deposits above mentioned, it is the confident expectation of those well informed on the subject that Salt Lake City will some day be the chemical center of the West, if not of the United States.

HYDROCARBONS

The Uintah Basin is noted as containing the largest deposits of asphalt and related bitumens found in America. In this region are found gilsonite, elaterite, sometimes called "Uintahite," and ozokerite. The only other places in which these rare minerals exist in large quantities, so far as is known, are Galacia, Roumania and Baku. These bitumens, re-

sembling tar, except that they possess a greater gloss and hardness when cold, are residues of petroleum and have important uses in the manufacture of high-class varnishes, japans, insulation, mineral rubber, acid proof paints and waterproofing compounds. Gilsonite is found in veins from a few inches to eighteen feet. Near Watson, the Gilson Asphaltum Company has mined one vein, the Rainbow, for three miles in length and to a depth of more than 400 feet in places. Select gilsonite is found at a distance of about 70 feet below the surface.

Elaterite is found in both Carbon and Wasatch counties, in the vicinity of Strawberry creek, in veins ranging from one to twenty inches wide. The ore is sacked and hauled to the railroad for shipment to refineries.

Ozokerite has been mined from an area in Central Utah twelve miles long and one to four miles wide, near the towns of Colton and Soldier Summit. This mineral also occurs in irregular vein deposits in fissures and crushed zones in limestones, shale and sandstone.

Asphaltic limestones and bituminous sandstones exist in large quantities but have not been mined as yet. Large de-

posits of cannel coal, valuable for the amount of oil which may be distilled from them, exist in Southern Utah.

SULPHUR

The largest sulphur deposit in the state is that known as the Cove Creek beds at Morrissey, about 20 miles north of Beaver. These deposits were owned and operated for years by the "Mormon" Church, but have since passed into the control of private enterprise. The holdings of the present owners comprise about 640 acres of sulphur-bearing land which varies slightly in sulphur content. This deposit has been worked intermittently for more than forty years and is capable of producing sulphur on a fairly large scale under favorable conditions.

Another sulphur deposit is known in San Rafael Canyon and has been described by the U. S. Geological Survey. This deposit is as yet undeveloped.

GYPSUM

Large deposits of gypsum occur in several localities in the southcentral part of Utah. Not all of these deposits are within reach of transportation facilities at the present time, but some of them stand untouched as yet and will supply the needs of generations to come.

There are two plants engaged in the treatment of gypsum, their output consisting of dental, casting, finishing, lava, and hard plasters. These plants are located at Nephi and Sigurd on the line of the Rio Grande railway. Some of the raw product is also shipped out of the state.

About 45,000 tons of gypsum are mined yearly and this output is valued slightly less than \$300,000.

LIME

The lime industry of Utah is becoming more and more important, and is fast growing. Since 1925 the lime production of the state has more than doubled, until at the present time about 45,000 tons of lime are produced per year, with a value of approximately \$375,000.

SAND AND GRAVEL

Utah's sand and gravel production is of considerable importance to the state. While the output of sand and gravel naturally varies considerably with building and construction conditions, the average annual output for Utah is almost 1,000,000 tons, with an approximate value of \$275,000.

CEMENT

There are three cement companies in the state; the Portland Cement Company of Utah with a plant at Salt Lake City, built in 1890; the Union Portland Cement Company with a plant at Devil's Slide, built in 1906; the Utah-Idaho Cement Company at Bakers, near Brigham City, built in 1910.

These plants are owned by three separate companies. There is a total investment in three plants of about five million dollars. The three plants employ about 200 men in direct labor. The total producing capacity is about 1,600,000 barrels per year.

CLAY PRODUCTS

The clay products industry in Utah has to do largely with common and face brick and hollow building tile, although sewer pipe and drain tile production are important items. Other structural productions of the Utah plants are platform paving brick, flue lining, wall coping, roofing tile, clay shingles, floor tile, art tile for mantels, store fronts, etc., and silica brick and blocks and decorative forms. No terra cotta or street paving brick are produced at the present time, although the latter is in contemplation and the former should receive consideration due to the tendency to employ terra cotta for exteriors of monumental buildings, store fronts and for decorative treatment of residences and other buildings.

The refractories produced include the silica brick and blocks, already mentioned, fire brick, assayers' muffles, crucibles, scorifiers, etc., and other like products.

It will be observed that a very large proportion of the products are what are known as heavy clay wares. In consequence the distribution is more or less local although the promenade tile used at the California Institute of Technology, at Pasadena, was furnished by a Salt Lake plant, and face brick has been shipped both to Los Angeles and Oakland to supply the demand for a superior product. As for the special refractories, the market is much more extended, a carload per month of assayers' supplies being sent to New York City. By the same token little competition is had from outside concerns in the case of commodities produced here. The most notable imports are wall tile, terra cotta, furnace-lining brick, etc.

So far as common brick is concerned, marketing is limited to a very short range from each factory and there is very little inter-territory shipping, but this is not true of face brick since the personal equation enters into the matter of selection due to color and texture preferences.

With respect to face brick it should be said that Utah is particularly favored by reason of a bewildering variety of colors, shades and textures that are to be had. Few localities can compare with ours in this respect.

There are a score of clay products factories in the state, extending from Cedar City on the south to Smithfield on the north. About two-thirds of the plants are very local in character and activity and are devoted exclusively to the manufacture of common brick. Several other plants manufacture only common brick and face brick. To these products, one or two plants add hollow building tile or drain tile or both while one of the largest concerns manufactures the whole group of heavy clay ware including common brick, and another large concern produces the whole group of heavy clay wares except common brick, and in addition manufactures assayers' supplies, silica brick and block and flower pots.

The total investment of the several

plants is at least \$5,000,000, and the annual output is about \$1,000,000. The annual payroll of the several companies is fully \$750,000, while much of the balance of income goes for Utah coal, local transportation, and local supplies and interest for capitalization, and profits are distributed locally to a very large extent.

Doubtless in the near future many industries will spring up to make use of Utah's immense and diverse resources of non-metallic minerals in addition to the established industries above mentioned.

OIL SHALE

Utah has been endowed with a generous share of oil shale. In the Uintah Basin alone the United States Geological Survey estimates there are 92,159,000,000 tons of shale which will yield, when distilled, as much as 15 gallons to the ton. Because of the low price of petroleum, exploitation of shale on a commercial scale has not been attempted, but whenever natural oil supplies fail, by reason of the vast tonnage of shale existing within the borders of the state, Utah should take its place as a leading producer of shale oils.

POTASH¹²

Three vast sources of potash exist in Utah: The brine of Great Salt Lake, the Marysvale alunite deposits, and potash mineral, carnellite, discovered in drilling the Crescent Eagle well near Thompson.

POTASH FROM ALUNITE¹³

Utah contains the biggest deposits of high-grade alunite in the United States. These deposits are located near Marysvale in Piute County in the Tushar range of mountains which have an elevation of 10,500 feet.

Before the war the possibilities of producing potash from this material were realized and during the war several large

¹² Potash in 1924, by G. R. Mansfield and L. Boardman, Bureau of Mines, Mineral Resources of the United States, Part II-6.

¹³ Alunite near Marysvale, Utah, by B. S. Butler and H. S. Gale, U. S. G. S. Bulletin No. 511.

and expensive plants were installed, among them being the Amour Fertilizer Corporation, the Mineral Products Corporation, and the Aluminum, Potash Corporation.

The potash content of the alunite is about 11.5 per cent potassium oxide, 35 per cent aluminum oxide, 3.5 per cent silica, 38 per cent sulphur trioxide, and 12 per cent water of crystallization. The alunite requires calcining to render its potash content water soluble and after leaching the product obtained is sulfate of potash, (K_2SO_4), a very desirable fertilizer and when pure it demands a premium price in the markets.

After the war the plants were shut down, not because of the failure of the processes but on account of the extremely high freight rates to eastern and southern states where the consumption of fertilizers is the greatest. The alunite deposits of Utah constitute a valuable asset whose future development as a source of domestic fertilizer supply awaits the needs of agricultural requirements.

POTASH FROM WASTE

Not only is it possible to obtain fertilizers from the sources above mentioned, also from the mill tailings. For example, tailings from the Utah Copper Company

are finely ground and delivered to the dumps near the Great Salt Lake at the rate of 40,000 tons per day. They contain about 6.5 per cent of potash. Investigations leading to the recovery of this potash content are being carried on.

Other non-metallics which occur in the state, deposits of which are of sufficient size and importance to permit of their being developed commercially, are phosphate rocks, sodium sulphate, clays, sands, marble, diatomaceous earth, antimony, arsenic bentonitic clays, and slate. At the present time the Industrial Department of the Salt Lake City Chamber of Commerce, the Utah Industrial Development Association, and the Department of Mining and Metallurgical Research of the Utah Engineering Experiment Station of the University of Utah are cooperating in gathering all possible information concerning the non-metallic resources of the state and likewise in securing representative samples of these non-metallics. In connection with this work it is expected that in the near future the state will undertake a mineral survey which will have for its object the obtaining of exact information as regards the location and composition of all deposits, concerning which information is now being collected by the organizations above mentioned.

Inquiries Solicited

As can be readily understood, it has been possible in the few pages of this booklet to merely call attention to the mineral wealth of Utah; to acquaint those who are not informed on the subject, of the merits of Utah as a mining state. Further information will be gladly furnished by the Secretary of the Mining Committee of the Chamber of Commerce of Salt Lake City to all those who wish to further acquaint themselves with Utah and its mineral wealth, as will also the Secretary of the Utah Industrial Development Association, or the Director of the Utah Engineering Experiment Station of the University of Utah.

Other booklets issued by the Chamber of Commerce of Salt Lake City are:

"Utah—The Unique," a 36 page booklet giving general information concerning the entire state; "Agriculture and Livestock in Utah," a 36 page booklet; and "Salt Lake City and Utah," a folder outlining seven one-day trips in and around Salt Lake City and trips to Utah scenic wonderlands and to the Tetons and Yellowstone National Park. It is planned to produce later in 1930 a booklet which will be known as "Salt Lake City—Famed for its Beauty and Individuality," and another booklet, "Industrial Salt Lake City."

LIVING CONDITIONS IN UTAH MINING TOWNS

THE best proof of the permanency of Utah's mining is given by the condition of its camps, as a mining town is called. Gone are the days when each miner carried his bedding and all his earthly belongings on his back and slept in a bunkhouse. At Bingham and Arthur, both Utah Copper camps, luxurious club-houses equipped with every device for recreation have been erected by the company. Copperton, a model town, consisting of brick bungalows with all metal furnishings of copper, the everlasting metal, has been built by the Utah Copper at the mouth of Bingham Canyon on a site ideal for the purity of its air, the beauty of its outlook and high percentage of sunny days. During 1929 twenty-nine new buildings were added to the housing facilities for employees and their families, thus extending the fully demonstrated advantages of this clean, sanitary and pleasantly sur-

rounded community near Salt Lake City.

The Park Utah Consolidated Mines Company, at Keetley, and the Tintic Standard Company at Dividend have also erected modern cottages, tennis courts, picture show houses, a golf course, stores, ice making plants, etc., and at Tooele the International Smelting Company has sponsored a home building campaign which has resulted in the erection of nearly 100 new homes. A new hotel and office building have also been constructed.

Not only have the metal mining companies of the state been keenly alive to improving the living conditions of their employes, but the coal mining companies have likewise been active along this line. All in all, it is believed that in no state in the Union have the mining companies paid more attention to the living conditions in their mining camps than have the mining companies of Utah. It is especially impressive to visitors.

UTAH TRAINING OF ENGINEERS IN MINING AND METALLURGY

THE need for study and training in mining and metallurgy was recognized early in Utah educational development.

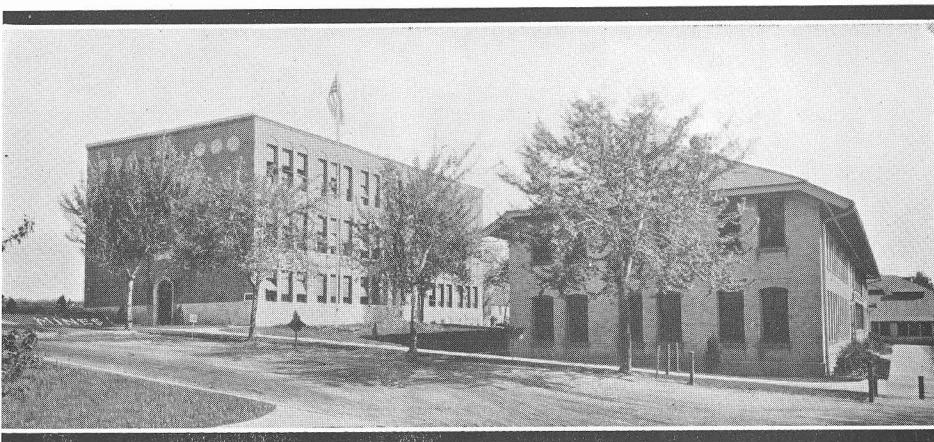
One of the first acts of the pioneers, after their arrival in the Great Salt Lake Valley, in 1847, was to establish schools. In 1850, only three years later, they founded the University of Deseret which later became the University of Utah. In 1901, mining was recognized as an integral part of the state's industrial development, and the State School of Mines of the University of Utah was formally established by legislative action. Since that time such courses have been offered by the University as it was be-

lieved would best fit young men for mining engineers or metallurgists, as is done at all mining schools of the country.

GRADUATE WORK IN MINING AND METALLURGY

Another distinctive feature of the School of Mines of the University of Utah is its Department of Mining and Metallurgical Research.

As has been stated by Mr. Louis S. Cates, former vice president and general manager of the Utah Copper Company and chairman of the advisory board to the University of Utah on its mining and metallurgical work, the solution, in the



The State School of Mines at the University of Utah, Salt Lake City

future, of the problems concerning the mining and metallurgical industry will depend upon industrial research, based upon fundamental research. In other words the industries, including mining and allied industries, which of course includes the metallurgical industry, must depend upon the scientists of our colleges and universities and upon the scientific bureaus of the Government, such as as the Bureau of Mines, to furnish the fundamental data the industries need in devising new processes or for increasing the efficiency of existing ones. This is essentially true of the mining industry and particularly in metallurgy.

The Department of Mining and Metallurgical Research of the University of Utah was established because of this fact and has striven ever since its inception in 1913 to render that service to the mining industry which will permit of its becoming more efficient in its mining and metallurgical operations and broaden the scope of its usefulness.

Each year five fellowships are awarded to college graduates who have had the necessary training in mathematics, physics, and chemistry, as well as mining, metallurgy, or geology, depending on the investigation which is to be pursued. Since the establishing of the Department in 1913, a total of 95 fellowships have been awarded by the Department. The

holders of these fellowships have come from 29 universities and colleges.

COOPERATION WITH U. S. BUREAU OF MINES

Utah is particularly fortunate in having the work of the Department of Mining and Metallurgical Research of its Engineering Experiment Station carried on in cooperation with the intermountain station of the U. S. Bureau of Mines.

In addition to the cooperation which the Bureau carries on with the University, it also maintains Economic and Health and Safety Sections at its intermountain station.

The work of the economic section has to do with the gathering of statistics in the Western states concerning the production of the metals and non-metallics.

During 1928, in recognition of Utah's importance as a mining center, the bureau established a health and safety station at the intermountain station, thus making it one of the ten safety stations which the Bureau has established throughout the country. The station at Salt Lake City is especially well-equipped for emergency rescue work, in case of mine disaster and for training in first aid.

Salt Lake City is the greatest non-ferrous smelting center in the world. Ores from nearly a dozen states are shipped to this city for reduction.

Utah's Production of Non-Ferrous Metals—1860-1929

	Gross Value	Dividends
Alta Ore Zone (No 1929 data)	\$ 37,811,015	\$ 3,019,048
Beaver County (No 1929 data)	54,867,108	7,865,104
Bingham	916,547,679	219,452,693
Park City	280,582,999	63,083,435
Tintic	324,750,864	51,968,619
Tooele (No 1929 data)	67,079,826	5,160,823
Miscellaneous (No 1929 date)	23,969,856	3,034,023
 Total.....	 \$1,706,999,947	 \$353,601,272

METAL PRODUCTION OF UTAH'S LEADING CAMPS 1929 SUMMARY

	Tons (Ore)	Gold (Ounces)	Silver (Ounces)	Copper	Lead	Zinc	Value	Dividends
Bingham	18,600,000	160,410	4,640,000	311,900,000	96,600,000	43,600,000	\$70,647,228	\$32,847,600
Park City	743,000	21,800	6,420,000	3,000,000	84,700,000	53,150,000	13,328,850	3,007,331
Tintic	420,000	42,000	6,130,000	2,800,000	85,600,000	750,000	10,128,311	2,294,859

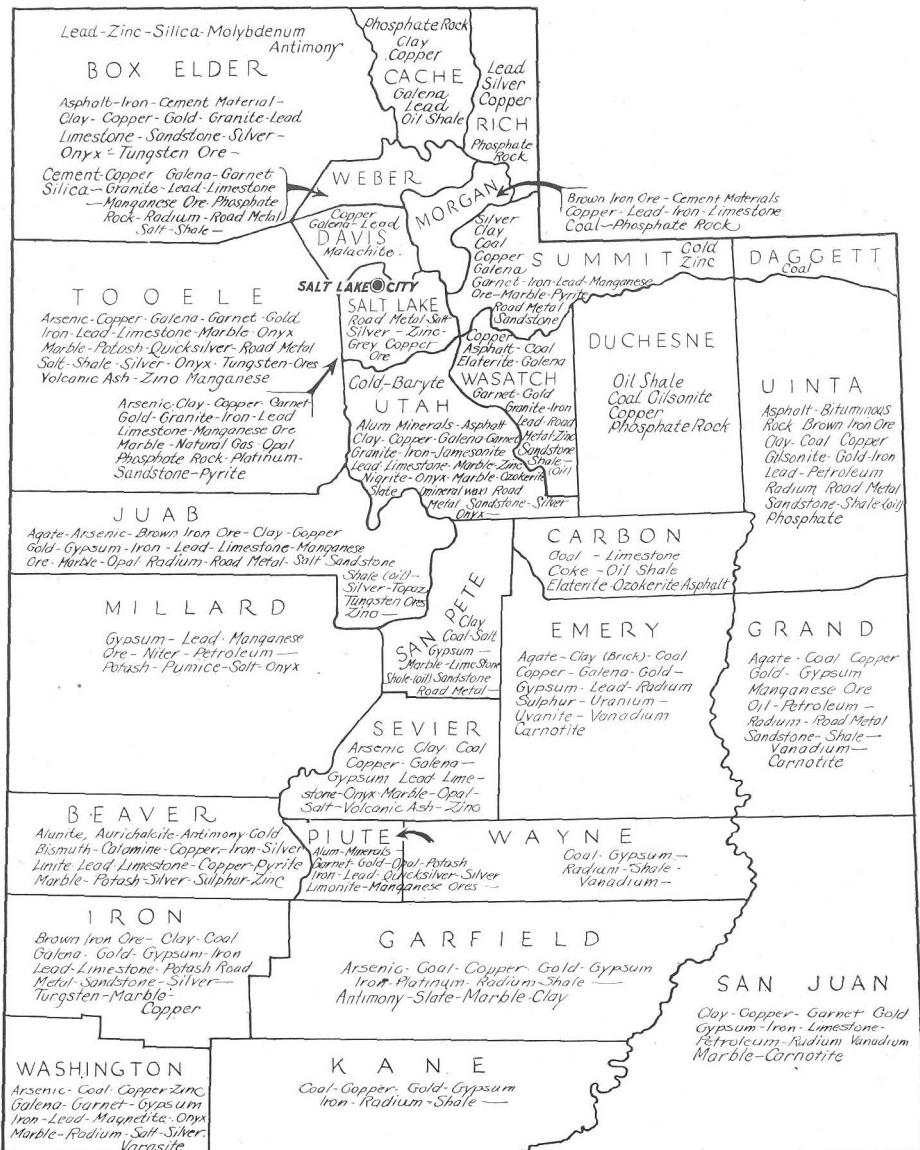
NON-FERROUS METAL PRODUCTION OF UTAH—1918-1929 (From Reports of U. S. Bureau of Mines)

Year	Tonnage	Gold (Dollars)	Silver (Ounces)	Copper (Pounds)	Lead	Zinc (Pounds)	Value (Dollars)	Dividends (Dollars)
1918.....	14,705,718	\$2,949,170	13,455,597	277,169,630	167,008,224	18,399,417	\$86,047,597	\$19,301,274
1919.....	6,745,423	2,159,471	11,649,961	124,061,807	123,829,051	4,431,024	45,169,328	11,994,766
1920.....	6,800,180	2,014,556	13,106,976	116,931,328	140,838,113	8,157,739	49,744,334	11,790,133
1921.....	2,137,522	1,769,905	12,251,998	30,891,403	89,187,269	69,390	22,023,790	4,840,167
1922.....	5,560,034	2,296,855	17,271,100	97,193,850	135,332,144	5,119,410	40,424,199	5,004,460
1923.....	12,752,998	3,076,213	19,137,470	222,393,572	203,447,793	11,330,913	66,472,911	10,007,106
1924.....	13,640,618	3,028,129	17,253,692	242,138,165	233,910,875	18,562,172	66,227,637	9,979,635
1925.....	14,479,247	3,675,543	21,276,689	236,486,540	306,669,824	52,611,732	82,701,394	12,690,210
1926.....	15,856,144	3,778,046	19,358,581	257,464,482	295,270,025	95,179,380	82,662,884	15,073,464
1927.....	15,757,074	4,008,453	18,606,950	256,933,278	302,570,040	99,185,443	73,626,632	15,463,017
1928.....	18,427,117	4,393,993	17,072,852	293,235,039	291,830,021	93,857,352	79,258,904	18,077,191
1929*.....	19,857,000	4,803,000	17,749,000	320,193,000	286,817,000	100,400,000	96,485,000	38,167,317

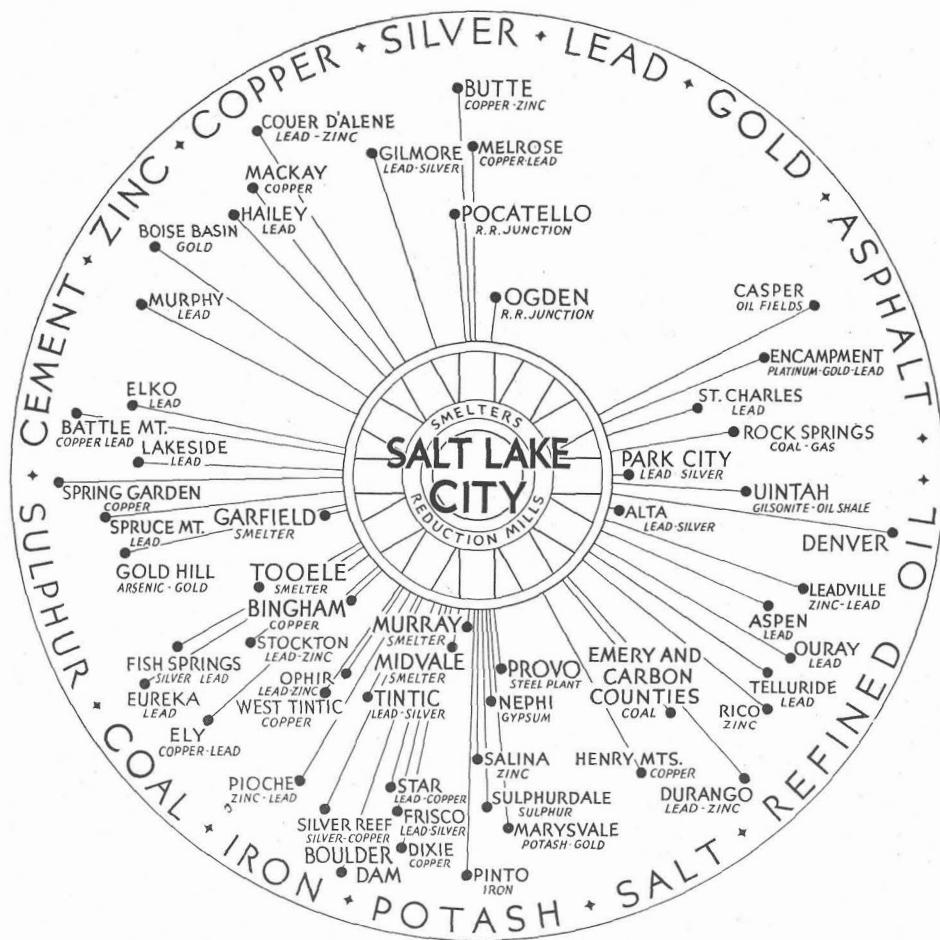
*Preliminary estimate U. S. Bureau of Mines on 1929 production.

MINERAL RESOURCE MAP OF UTAH

Every county in Utah has its store of mineral wealth. Altogether, 210 different minerals are found in this state, most of them occurring in tremendous quantities. Such copiousness of mineral deposits as is indicated on the map, insure the future importance of Utah as a mining state.



THE HUB OF THE NON-FERROUS MINING AND SMELTING INDUSTRY OF AMERICA



DISTANCES

Salt Lake City to Butte (by rail) 433 miles.

Salt Lake City to Denver (by rail) 616 miles.

Salt Lake City to Spring Garden, 636 miles.

Salt Lake City to Boulder Dam, 485 miles.

The area of 800,000 square miles embraced within this circle, with Salt Lake City as the center, produced in the last twenty years:

79.87% of all the GOLD; 91.9% of all the SILVER; 53.61% of all the LEAD; 77.47% of all the COPPER; 26.55% of all the ZINC, in the United States, including Alaska.